GDOT

Georgia Department of Transportation

GEORGIA DEPARTMENT OF TRANSPORTATION

BRIDGE AND STRUCTURES DESIGN POLICY MANUAL

OFFICE OF BRIDGE
AND STRUCTURAL DESIGN

PAUL V. LILES, JR., P.E.
STATE BRIDGE DESIGN ENGINEER

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Disclaimer: This manual is intended to be an aid to designers working on projects for the Georgia Department of Transportation. It is not to be used as a substitute for sound engineering practice and will be used at one's own risk. The Georgia Department of Transportation and the authors of this document are not responsible for the consequences of the use and misuse of the contents of this document.

The latest version of this document is available at:

http://www.dot.ga.gov/doingbusiness/PoliciesManuals/roads/Pages/DesignPolicies.aspx

Other helpful links:

GDOT Bridge Design Home Page:

http://www.dot.ga.gov/doingbusiness/PoliciesManuals/bridge/Pages/default.aspx

GDOT Bridge Design Software:

http://www.dot.ga.gov/doingbusiness/PoliciesManuals/bridge/Pages/PCBridgeDesignSoftware.aspx

GDOT Bridge Microstation Customization:

http://www.dot.ga.gov/doingbusiness/PoliciesManuals/roads/software/Pages/Customization.aspx

Please send constructive comments to the Bridge Design Committee care of Ted Cashin: tcashin@dot.ga.gov

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The Bridge and Structural Design Committee

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Greg Grant, P.E. – Wolverton and Associates

Contributing Authors
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Part I – Design

1 Bridge Office Administration

1.1 Organization

The State Bridge Design Engineer (Paul Liles) is the head of the Office of Bridge Design, and reports directly to the Director of Preconstruction (vacant) just as the heads of Urban Design, Road Design, Environment/Location, Right of Way, and Consultant Design do. In general, The Office of Bridge Design does not manage complete design projects like the other design offices and instead supplies bridge plans to project managers in those offices (as well as the district design offices). Essentially they are a sub-consultant to the other offices. The Bridge Office also oversees design of walls, culverts, sign supports, and anything else requiring structural expertise.

There are two assistant office heads, Bill Ingalsbe and Bill DuVall. The office head and his two assistants plus administrative staff are referred to sometimes as “the front office”.

Bill DuVall keeps track of Special Provisions, manages sections of the construction specifications relating to bridges, serves as a liaison for non-DOT bridge projects (for local governments who don’t have bridge expertise but want to use DOT guidelines or funding), tracks bridge costs using data from Contract Administration, and reviews plans.

Both Bills manage design groups, oversee most design policies and review plans including hydraulic studies. There are 8 design groups within the Bridge Office plus a group dedicated to Hydraulic issues. Most bridge hydraulic questions should be addressed to that group (Susan Beck is the group leader). The Hydraulics group prepares or reviews all the preliminary layouts for bridges over streams as well as some culverts, though most culverts are sized by roadway engineers.

1.2 Other offices with bridge-related responsibilities

1.2.1 Bridge Maintenance

The State Bridge Maintenance Engineer (Mike Clements) serves as an assistant to the State Maintenance Engineer (David Crim), part of the Division of Operations. His responsibilities include inspecting all the bridges and bridge culverts in the State (including county bridges) every two years. He maintains maintenance records, sets sufficiency ratings of bridges and maintains old plans for bridges. This office evaluates bridges and determines if they must be “load limited.” They also do a lot of consulting and contracting work relating to inspection and maintenance projects. It is important to coordinate with the maintenance office when doing work that will affect existing bridges.

During the Concept phase for any project that will widen an existing bridge, the project manager should coordinate with Bridge Maintenance to get a recommendation on whether the bridge is suitable for widening or should be replaced (a bridge could also be replaced if the cost of widening would exceed the cost of replacement).

For “typical” bridge design work coordination is necessary with the Office of Maintenance for the following items: salvage material coordination, long and heavy load hauling coordination, bridge condition surveys (widenings), maintenance on existing or parallel structures to be included with widening or paralleling plans. The Office of Maintenance provides important feedback to the State Bridge Engineer on the effectiveness of certain design details (like whether a certain kind of joint works well, or if some detail seems to be causing cracks in concrete).

1.2.2 Bridge Construction

The State Bridge Construction Engineer (Melissa Harper), serves as an assistant to the State Construction Engineer (Randy Hart), part of the Division of Construction. The State Bridge Construction Engineer serves as a resource for district construction personnel regarding bridges, participates in training, troubleshoots construction problems, sets bridge construction policies, and makes recommendations to designers on the use of cofferdams and seals. She has two assistants, Mike Garner and Lisa Sikes, who cover the middle and southern parts of the state respectively and can also make cofferdam and seal recommendations.

1.2.3 Geotechnical Bureau

The State Geotechnical Engineer (Tom Scruggs) heads the Geotechnical Bureau, and serves as an assistant to the State Materials and Research Engineer (Georgene Geary), of the Office of Materials and Research, which is also part of the Division of Construction. The Geotechnical Bureau writes or reviews the Bridge, Wall and Culvert Foundation Investigations that recommend the type of substructure, pile capacity, special construction situations, etc., for each bridge in the state. They also deal with construction problems of a geotechnical nature, for instance, when piles don’t reach minimum tip or bearing as well as inspection of drilled shafts. They are responsible for the special provisions such as, drilled shafts and pile driving.

1.2.4 Engineering Services

The Office of Engineering Services acts on behalf of the FHWA in reviewing projects and advising on constructability. They report directly to the Chief Engineer and are therefore independent of the Preconstruction Division. They set a number of policies in regards to when bridge funding is allowed and review all concept reports and design exceptions. They also coordinate and conduct Preliminary and Final Field Plan Reviews as well as value engineering studies. They review all hydraulic studies (for PFPR) as well as bridge plans (for FFPR). They are the central coordinator for writing specifications.

1.2.5 Federal Highway Administration (FHWA)

Obviously the FHWA is not part of the Georgia DOT. However they have an essential role especially on “full oversight” projects which includes all projects related to interstate highways and projects over a certain dollar amount. Correspondence is sent to Rodney N. Barry, Division Administrator. FHWA has a bridge specialist, Leon Kim, who provides expertise, direction, and reviews.

1.3 Consultants and Bridge Design

1.3.1 General

Consultant projects are almost always managed by a GDOT Project Manager assigned to Road, Urban, or Consultant Design even if the project consists primarily of bridge work. This is because most bridge projects involve other services, which are best handled by project manager who are more accustomed to handling multi-discipline projects. However, the Bridge Office does occasionally issue task orders for hydraulics and bridge design when the schedule or workload exceeds the capacity of the design groups. On projects with bridge work, a liaison from the Bridge Office will be assigned to the project, typically this liaison will be a Group Leader (also referred to as Design Group Manager). The liaison will be the point of contact for the bridge work on that project and will also coordinate with other DOT offices on bridge activities. Much of the correspondence and coordination with other offices described below will be done by the liaison but consultants should be aware of this activity and make sure they incorporate the results in their plans.

Consultants are reminded that if their contract is with the Georgia Department of Transportation, ALL design questions and decisions regarding project requirements MUST be directed to the GDOT Project Manager for distribution to the appropriate office. Consultants shall not take direction from outside agencies for decisions regarding GDOT projects.

1.3.2 QC/QA and Bridge Design Reviews of Final Plans

Consultants are responsible for the quality and content of their plans. Prior to a final review by Bridge Design, all Quality Control and Quality Assurance procedures must be followed and documented by the consultant. This includes design checks, independent sets of quantities, and peer reviews. The drawings must be stamped by the consultant when submitting for review even though the plans are not for construction. Plans must be stapled and include pertinent roadway plans as well as BFI’s and correspondence relating to cofferdams, salvage, bridge and deck condition, stakeout, etc. Include two full-size sets of bridge plans (one for markups and one to keep on file) as well as plans and Wall Foundation Investigations for any MSE or other contractor-designed walls on the project. Design notes, program runs, and calculations are not usually required, but should be ready if they are requested.

Typically the plans will be reviewed in Bridge Design group, followed by reviews by the front office. The plans will then be returned to the consultant for corrections. A list of special provisions will be returned to the consultant which must be saved and given to the project manager to include in the final plans package for Construction Bidding Administration.

In the second submittal, include the original markups as well as two full-size sets of corrected plans. The plans have not been accepted by Bridge Design for FFPR or construction until the markups are addressed and an e-mail or letter accepting the plans is issued by the front office (typically one of the assistants who will verify the changes have been made). Once the bridge is accepted, any subsequent changes must be done using revision blocks and copied to Bridge Design.

1.3.3 Schedules for Bridge Design

All GDOT projects follow the Plan Development Process (PDP), which outlines project phases and activities during each phase. It is available on the GDOT website. Bridge Designers should be aware of the process and their part in it to assure that project schedules are achieved. In general, the following activities are of particular importance:

Concept

Bridge designers should ensure that SIA's (Bridge Maintenance reports), Bridge and Deck Condition surveys (if needed) have been requested by the GDOT PM. The decision to widen or replace a bridge is determined during the concept phase.

Bridge designers may be asked to provide conceptual bridge and/ or wall lengths, widths, and costs. Timely responses to these requests are all that's needed in this phase.

When project complexity requires it, PM's should ask for a Project-Level Bridge designer to attend the Concept meeting.

Preliminary

A critical part of project funding lies in the year that Right Of Way (ROW) purchase can be authorized. This is a great concern for the Roadway PM because Preliminary plans must be complete before ROW plans can be completed. The savvy Bridge Project Engineer understands that if the ROW funding year is near, his Preliminary Plans need to be completed and submitted for approval long before the scheduled ROW authorization date to avoid being on the critical path.

However, Bridge Designers should not work on Preliminary design until the Concept is approved! In some cases, the GDOT PM will give Notice to Proceed (NTP) prior to approval of the Concept; this is considered appropriate in some cases. Roadway widths, alignments, and grades may be in flux for some time after that so a substantial amount of roadway work needs to be done before the preliminary bridge plans can be completed. However the final roadway profile may depend on structure depths and clearances relating to the bridge, so some back and forth can be expected. Consultants should expect to be asked to turn in preliminary plans months before the PFPR to provide adequate time for review and acceptance of the layout before the PFPR request.

When project complexity requires it, PM’s should ask for a Project-Level Bridge designer to attend the PFPR.

Final

The *most* critical part of project funding lies in the month/year that the project is scheduled to be let. There are many administrative tasks that must be completed by GDOT in order to put the project out to Contractors; therefore final Bridge Plans must be approved long before the let date. The savvy Bridge Project Engineer understands that final bridge plans need to be submitted for review *at least* six months prior to the scheduled let date to avoid being on the critical path. Final (preferably reviewed and accepted) bridge plans must be turned in to the project manager five months before the letting to provide time for the FFPR request. The FFPR itself is to be held 16 weeks prior to the letting.

However, Bridge Designers should not work on Final Plans until the Preliminary Plans (roadway) are approved! In some cases, the GDOT PM will give Notice to Proceed (NTP) prior to the PFPR; this is considered appropriate in some cases.

Once final plans have been reviewed by the Bridge Office and returned to the consultant, the comments should be immediately incorporated and returned to Bridge Office with the reviewed set to Bridge Design. At that point, the Bridge Office can mark the plans as 100% complete and ready for letting.

Bridge Designers usually do not need to attend the FFPR because at that point the Bridge should be ready for letting, however this can vary by project circumstances. However, the savvy PM knows that having all disciplines in attendance at the FFPR can help avoid unnecessary comments in the FFPR report.

At 10 weeks prior to the let date, final plans are due to the Contracts Administration Office of GDOT. Plans need to be stamped and signed. After this submission, any changes to the plans must be handled by formal revision.

At 5 weeks prior to the let date, one stamped and signed set of the final plans or revised final plans are sent to the GDOT print office to be scanned, printed, and sold to contractors.

Shop Drawings

It is important that shop drawings are reviewed and returned in a timely manner. Two weeks is considered the outside limit of time to review drawings.

1.4 Correspondence

For consultants, any Interdepartment Correspondence or letters on DOT letterhead must go through the appropriate Bridge Design liaison. All transmittals from consultants should have the PI number, county, description (e.g. “SR 1 over Altamaha River”), and project number. In general, coordination letters with local governments, agencies, and officials should go through DOT.

1.4.1 Phone Numbers on Correspondence

All correspondence with members of the public shall have printed or typed thereon one or more telephone numbers to which responses or questions concerning such correspondence may be directed. Within the Bridge Office, all correspondence related to projects shall have a name of a contact person and that person’s phone number (including area code) included in the body of the letter.

1.4.2 P.I. Number on Correspondence

On all correspondence related to Projects, include the Project P.I. Number along with the Project Number in the heading of the letter.

1.4.3 State Bridge Engineer Signature on Correspondence

The following types of correspondence do not require the signature of the State Bridge Engineer:

1. Transmittals of plans to various DOT offices. These should be done using a transmittal letter (electronic green sheet) as a cover letter, not with Interdepartmental Correspondence.
2. Requests for BFI, site inspection (stake-out), bridge and bridge deck condition surveys, salvage of existing bridge parts, recommendations for cofferdams and seals.
3. Letters distributing and transmitting shop drawings will be initialed for the State Bridge Engineer by the clerk in charge of processing them.

Copies of letters for items in Nos. 1 and 2 should be placed in the in-box of the Assistant State Bridge Engineer – Design. Other correspondence should be given to the secretary by e-mail or hard copy for preparation for signature by the State Bridge Engineer.

1.4.4 Correspondence With Legislators, Citizens

When preparing correspondence concerning particular projects with members of Congress, state representatives and senators, and members of the public, send a copy of the letter to the DOT Board member representing that district.

1.4.5 Outgoing Correspondence

When preparing correspondence on the PC that will require the signature of the State Bridge Engineer, put the word ‘draft’ on the page. The letter should be e-mailed to the secretary who will prepare it for signature by the State Bridge Engineer. A copy will be returned to the group.

1.4.6 Correspondence With Contractors

Send a copy of all correspondence with the contractor to the proper District Office when the correspondence concerns the Contractor’s plans and/or design notes. Do not send copies of the correspondence on routine shop drawing approvals or rejections. This procedure is an effort to help the District personnel evaluate the need for time extensions on projects where the Contractor proposes changes in the contract plans. When responding to questions from the Contractor or solutions to construction problems, the response should be given to the Project Engineer for transmittal to the Contractor.

Once a project has been advertised for letting, it is under the control of the Office of Contract Administration. If any contractor calls with questions on the project, they should be referred to the Office of Contract Administration. If the question concerns a bridge, that Office will contact the Bridge Office for the proper reply. The Office of Contract Administration will then provide that information to all contractors who have purchased plans.

Requests from Contractors to place cranes on bridges will be reviewed by the Assistant State Bridge Engineer – Design.

1.4.7 Bridge Condition and Bridge Deck Condition Surveys

When beginning work in the concept phase of bridge widening projects, the designer shall request condition surveys on the existing bridge and the existing bridge deck. It is important to request these early on because it can take up to 6 months to get them completed. The request for a bridge condition survey should go to the Office of Maintenance. The request for a bridge deck condition survey should go to the Concrete Section, Office of Materials and Research. Each request should include:

1. A description of the bridge (e.g., SR 16 over Flint River)
2. The milepost location of the bridge
3. A location map of the bridge site
4. The proposed letting date for the project.
5. The Bridge ID and Serial numbers.
6. The deck condition survey request should ask whether the existing deck is grooved, and in which direction.
7. The Project Number, County and P.I. Number.
8. A description of any anticipated work beyond widening, such as placing an overlay on or jacking of the existing bridge.

1.4.8 Routes for Hauling Bulb-T PSC Beams

When developing plans for bridges requiring long Bulb-T PSC beams, the Designer shall determine the gross haul weight of the beams (the weight of the beam plus the weight of the trucking apparatus that will carry the beam to the job site). If the gross haul weight is 150,000 lbs. or greater [allowing 45,000 lbs. for the trucking apparatus], the Designer shall, with the assistance of truck routing personnel from the Office of Maintenance, investigate whether the beams can satisfactorily be trucked to the job site.

If the beams are over 90' in length, the Designer shall provide the length and job site location to the Office of Maintenance truck routing personnel and request that a route for beam delivery be determined.

1.4.9 Transmittal Requirements

1.4.9.1 Preliminary Layouts

FHWA for approval (Interstate bridges and full oversight projects):
1 set with Roadway Plan and Profile sheets (mainline and crossroad), Typical Sections and Project Cover Sheet. 1 copy of the Hydraulic Study including the scour report. ALL PRINTS HALF SIZE.

Railroad for approval:
6 half-size sets (include railroad cross-sections with the submittal) to the Office of Utilities. For widenings of steel bridges, note on the Layout that the existing structural steel will or will not be repainted. If repainting, note whether existing paint is lead based.

If the affected railroad is a subsidiary of Norfolk Southern Corporation, request that the name, address and telephone number of the person to contact before commencing subsurface investigation. Complete and include the Norfolk Southern bridge data sheet (in Appendix A of this section).

Subsidiaries of Norfolk Southern Corporation include Norfolk Southern Railway; Central of Georgia Railroad (not to be confused with Georgia Central Railroad, which is an independent "short line" railroad); Georgia Southern & Florida Railway; Tennessee, Alabama & Georgia Railway; Georgia Northern Railway; and Alabama Great Southern Railroad.

If the submittal is to CSX Transportation, Inc. (do not call it CSX Railroad), include a copy of the form letter, signed by the Bridge Engineer, requesting permission for the Department to make borings on Railroad Right-of-way. See the standard letters section for a copy of the submittal letter to CSX Transportation, Inc. Complete and include the CSX bridge data sheet (in Appendix A of this section).

There are *no* subsidiaries of CSX Transportation, Inc. Former railroads identified as Seaboard Coast Line Railroad, Louisville and Nashville Railroad, Georgia Railroad, Atlanta and West Point Railroad, Gainesville Midland Railroad, Atlantic Coast Line Railroad, and Seaboard System railroad are now part of CSX Transportation, Inc. and should be identified as CSX Transportation, Inc.

In addition to the above two major railroads, there are about 20 “short line” or small railroads operating in Georgia. Call the Office of Utilities if there are any questions about the identification of these railroads.

Lab for BFI:
2 prints with a Project Cover Sheet, Plan and Profile sheets and location sketch. Please include the date that you anticipate needing the BFI in order for your work on the bridge to proceed.

Project Manager:
2 full-size prints of the Preliminary Layout.

Environment/Location (Stream crossings):
1 print of Layout with Cover sheet and Plan & Profile Sheet. Send to the attention of the NEPA-GEPA Section Chief.

Site Inspection:
All bridge sites are inspected by representatives of the District Engineer. Send two prints of the Preliminary Layout along with a print of the Typical Section requesting that the endrolls and intermediate bents be staked out. Send the request letter to the District Engineer to the attention of the District Preconstruction Engineer. Request that the results of the inspection be provided to the Bridge Office in writing. Requests should include the following, at a minimum:

a. For stream crossings, request that the toes of the endrolls and any intermediate bents near or in the stream be staked. Clearance from the top of bank to the toe of the endrolls and to intermediate bents should be checked.
b. For grade separations, request that the toes of the endrolls and intermediate bents adjacent to roads or railroad be staked. Horizontal clearances from the road or railroad to the bent should be verified as well as the location of the toe of the endroll.

Front Office:
Provide three half-size prints to the State Bridge Design Engineer for his distribution. Consultants should keep in mind that if the layout changes during final design, revised preliminary layouts with a revision date should be submitted again.

1.4.9.2 Construction Plans for Approval

FHWA (Interstate bridges and full oversight projects):
One set with one copy of the BFI Report. ALL PRINTS HALF SIZE.

Railroad:

Three full-size and two half-size complete sets of bridge plans to the Office of Utilities for transmittal to each railroad. Shoring plans requiring railroad approval shall be submitted directly to the railroad once they have been approved by the Bridge Office.

Preliminary Construction Plans:

Construction Office (Stream Crossings):
1 set including Plan and Elevation Sheet and Intermediate Bent details along with a copy of the BFI Report requesting the recommendation of the Assistant State Construction Engineer – Bridges concerning the need for cofferdams and/or seals.

Final Bridge Plans for Front Office Review:
1 *stapled* set with the BFI and Project Cover Sheet. Include the cofferdam recommendation and bridge salvage letter results. If the plans are for widening or paralleling an existing bridge, include a copy of the Maintenance Bridge Condition Survey letter and a copy of the OMR Bridge Deck Condition Survey letter. Include a copy of the letter reporting the results of the stake-out. For bridges over or carrying railroads, include a copy of the railroad's letter approving the Preliminary Layout. For interstate and full oversight projects, include a copy of the FHWA approval of the Preliminary Layout. If the bridge is a stream crossing with concrete bents with spread or pile footings, include the letter from the Office of Construction with recommendations as to seals and cofferdams. If there is an existing bridge at the site, include a copy of the letter indicating whether any items are to be salvaged.

Construction Plans (Prints):
1 set for the Bridge Office file, with Project Cover Sheet

Construction Plans (Reproducibles):

Send one set of reproducibles to the Project Manager (Urban or Road Design Group Leader or District Preconstruction Engineer). Include any required Special Provisions as well as the Specification checklist provided by the Assistant State Bridge Engineer – Administration.

When transmitting construction plans to the Districts, send a copy of the transmittal letter to the Assistant Director of Preconstruction in the General Office.

Shop Drawings:

Approved Shop Drawings:

- 1 set to the field
- 1 set to remain in the Bridge Office file
- 2 sets to the contractor
- 2 sets to the Lab. Shop drawings for concrete items should be sent to the Branch chief for the Concrete Section (Jeff Carroll); other items (except metal deck forms and detour bridges which are not sent to the lab) should be sent to the Branch chief for the Inspection Section (Kevin Ledford).
- 1 set to the consultant (if applicable)
- 1 copy of the transmittal letter to the appropriate District Office

Shop Drawings requiring correction:

2 sets to the contractor with the letter indicating that they should be forwarded to the fabricator if applicable; the letter should also indicate how many corrected sets are needed.
1 copy of the transmittal letter to the field
1 copy of the transmittal letter to the appropriate District Office

Sometimes, DOT field personnel will request that all shop drawings and correspondence go through their office. These requests should be complied with, but it should be pointed out to the field that this will slow down the review and approval process. Shop drawings being sent to the Lab should always be sent directly there.

1.4.10 In-House Mailing Requirements

Plans may be transmitted to Urban Design or Road Design or to the District Offices using “green sheet” or computerized transmittal forms. If the item to be transmitted can be folded to approximately letter size, it can be placed directly in the Office out-box with the transmittal form. Rolled plans being sent to Urban Design, Road Design, other offices within the General Office, the Forest Park lab or the Office of Environment/Location can be sent using a “green sheet” or computerized transmittal form and can be placed directly in the Office out-box. Mail for Districts 6 and 7 is picked up by couriers, so rolled plans do not require a mailing label and can be placed directly in the Office out-box with the transmittal form. Rolled plans being transmitted to the other Districts require mailing labels before they will be picked up for mailing, so they should be put in the secretary’s in-box with the transmittal form for a mailing label to be prepared. Copies of all transmittal forms should be placed in the in-box of the Assistant State Bridge Engineer – Design.

1.4.11 Public Access to Project Records

All project records and correspondence are to be made available to the public when requested. The only exceptions are documents within which the Department and the Attorney General’s Office communicate on an attorney-client basis; all such documentation should be kept in a separate file from other project records. See MOG 3A-3 for additional requirements and forms to be used.

1.4.12 Special Provisions

Project Special Provisions dealing with Special Construction features or construction sequences are prepared by the Assistant State Bridge Engineer, Administration. The Group Leader will provide advice and information to the Assistant State Bridge Engineer. Consultants will be responsible for preparing Special Provisions to be reviewed by Bridge Design for their projects when a specification is not available.

1.4.13 Construction Time Estimates

Do not send bridge plans to the District or to the Construction Office for preparation of a construction time estimate. The District Construction Engineer should obtain a complete set of plans from the Project Manager to use in preparing the construction time estimate so that he can account for items not in the bridge plans which can affect the bridge construction time.

1.4.14 FHWA Review Requirements

All projects, regardless of the type of funding, which involve work in the limits of interstate rights-of-way shall be treated as non-certification acceptance type projects for that portion of the work within the confines of the interstate right-of-way. This means that preliminary layouts and final plans shall be submitted to the FHWA for review and approval. In other words, these projects will be treated the same as Interstate type work. All transmittals to the FHWA should be sent to the Division Administrator, Rodney N. Barry.

All Federal-aid projects, regardless of the location, involving bridges with estimated total deck areas greater then 125,000 ft^2, tunnels, unusual or moveable bridges, unusual or major hydraulic structures, unusual or major geotechnical structures shall be treated as non-certification acceptance projects. This means that preliminary layouts and final plans shall be submitted to the FHWA for review and approval, the work will be subject to construction inspections and inspections for final acceptance, and plan revisions shall be submitted to FHWA for review.

1.4.15 Response to Field Plan Review Reports

The field plan review (preliminary and final) inspection report may include bridge items that are specifically identified as requiring a response. There may be other items regarding the bridge plans that should be responded to. It will be the responsibility of the Design Group Leader to write a letter responding to the items which are indicated as requiring a response as well as to other items which the Group Leader feels should be responded to for signature by the State Bridge Engineer or by e-mail with a copy to the Assistant State Bridge Engineer – Design. This letter should be written only in response to the final, signed report, not a draft of the report. The letter should be addressed to the Project Manager with a copy to Engineering Services. The letter should be prepared promptly as the Project Manager is required to respond to PFPR comments within 4 weeks and to FFPR comments within 2 weeks. Note that you do not have to concur or comply with recommendations in the PFPR or FFPR report. You do have to respond to each. If your response is negative, provide an explanation. Consultants may be asked by the liaison to write responses to the comments.

1.4.16 Plans File

A Project Cover Sheet shall be included with all Bridge, Wall, Culvert or other plans inserted in the Plans File rack in the Bridge Design Office. Plans shall be placed in the

Plans File as soon as possible once final plans are completed. Plans shall be removed promptly when notice of final acceptance is given.

1.4.17 Revisions Prior to Letting

If, after final plans (including revisions resulting from the Final Field Plan Review) have been transmitted to the Project Manager, a revision is necessary, the following procedure shall be used:

1. Check with the Project Manager to find out whether the plans can be revised. If they can, revise the plans and transmit them to the Project Manager.
2. If the plans can not be revised, the Designer, in consultation with the Assistant State Bridge Engineer – Administration shall prepare an amendment listing the required changes. This amendment will be provided to the Office of Contract Administration by the Assistant State Bridge Engineer – Administration.

Revised quantities can be changed prior to the advertisement (4 weeks prior to the letting), but after the plans are in the hands of the public, the original quantity can only be lined through with the new quantity written in adjacently.

1.4.18 Revisions After Letting

Use the following guidelines when revising plans on Projects let to contract (“Use on Construction” revisions):

1. After the Contract is awarded, quantities in the Summary of Quantities can be revised by lining through the original quantity and placing the new quantity adjacent to that.
2. Revise quantities on the detail sheets when appropriate by lining through the old quantity and entering the new quantity.
3. Identify the revision by a symbol (typically a triangle with the revision number inside).
4. Revisions on major Interstate Projects must be cleared by the FHWA before being finalized. It should be noted in the transmittal letter that the revision has been discussed with the FHWA.
5. Care shall be taken not to change the character of the work without consulting with the Office of Construction concerning a Supplemental.
6. The transmittal letter should contain brief and concise statements of the changes; the transmittal should indicate any pay items for which the quantities changed.
7. Revisions made to agree with shop drawings should be stated as such on the transmittal letter.

1.4.19 Amendments

Once a project has been let, amendments to the contract must be posted to the plans. Amendments should not be posted until the project has been awarded or rejected.

If the project is rejected, the amendments should be made as soon as possible so that they will be in the plans when the project is re-bid. The amendments should be marked as revisions, and any other revisions that need to be made should be made at this time. The Group Leader should make sure that the revisions will be posted before the plans are re-advertised. Otherwise, another amendment will have to be issued (see Revisions Prior to Letting).

If the project is awarded, all changes to the plans which are included in the amendments should be made once a copy of the amendments is received from the Office of Contract Administration. Changes should be made *exactly* as shown in the amendment. These changes should be marked as revisions, with the notation "Per amendment" in the Revision box. No other changes should be transmitted with these revisions. If any other changes to the plans are needed, the changes due to the amendments should be transmitted, then, at a later date, any other revisions can be handled. In the transmittal letter for the amendments, include the comment "As per amendments". This is to be sure that everyone understands that the changes to plans are actually already part of the contract since they were issued as an amendment.

1.4.20 Construction Changes and Revisions

Once a Contract has been awarded, any bridge plan changes or revisions made for the convenience of materials suppliers or the contractor shall be approved by the State Construction Engineer – Bridges or the field engineer in charge of the Project. This policy must be carefully followed to minimize conflicts among materials suppliers, contractors, DOT personnel and other interested parties. Since the Districts are charged with the responsibility of administering construction contracts, any revisions or changes affecting said contract must be coordinated with the District Construction Office. All proposed changes originating with material suppliers or fabricators must be submitted to the Department by the prime contractor. Revisions that meet these requirements are prepared by the designer and submitted to roadway project manager to issue formally.

When plan changes are required after the letting (due to field conditions, mistakes, omissions, etc.), a USE ON CONSTRUCTION revision is required. The affected sheets must be routed to the roadway project manager and issued as a formal revision (see 1.4.18).

It is essential that the Department have a permanent record of bridges when the Contractor redesigns the project. Though all kinds of redesigns are possible, it is probably most common when t-beam bridges are redesigned to utilize Type I Mod beams or the PSC beams are re-designed (steel beam shop drawings are always added to the plans as well). After the redesign is approved, make sure you obtain full-size prints. If possible have the Contractor engineer put a title block in the upper right and use sheet numbers as shown in the roadway plans. If the P&E sheet for the bridge was roadway sheet 64 of 135, then the redesign sheets would be 64A, 64B, etc. If only the beam design is changing then you would use the sheet number of the beams. This would then be submitted and distributed for scanning into the electronic record set directly, similar to the as-built foundation sheet (see 1.4.22), not as a Use on Construction revision.

1.4.21 Shop Drawings

All shop drawings for bridge projects shall be submitted by the contractor, not by the fabricators. If shop drawings are received without a transmittal letter from the contractor, the fabricator should be notified that the review of the drawings will not commence until a letter from the contractor covering the drawings in question is received.

1.4.21.1 Shop Drawing Logs

The designer shall keep a shop drawing log showing the date of the submittal to the Bridge Office, date of return to the Contractor and an indication of approval or exceptions to the shop drawings.

1.4.21.2 Shop Drawing Submittal Letters

All original shop drawing transmittal letters, both “in” and “out” shall be sent to the General Files. This should be done by including the original letter with the sets of drawings provided to the office clerk for transmittal. All other parties shall get photocopies of these letters.

1.4.22 As-Built Foundation Information

Each set of bridge plans shall include an As-built Foundation Information sheet (also see section 8.3). This sheet will include spaces for field personnel to record the tip elevations of all piles as well as the bottom of footing elevations for all footings and the bottom elevations of seals, where present. For pile footings, a schematic should be included, with the piles numbered from left to right, then back to ahead. When the completed as-built information sheet is returned from the field, the following procedure should be followed:

1. Transfer the field data to a reproducible or scan the sheet after adding the revision date.
2. Put one print in the Office plans.
3. Send one half-size copy to the Geotechnical Bureau at the lab.
4. For stream-crossings only:
    a) Send one half-size copy to the Bridge Maintenance Engineer with a half-size copy of the Plan and Elevation sheet.
    b) Send one half-size copy to Bridge Hydraulics with a half-size copy of the Plan and Elevation and substructure sheets along with the copy of the BFI from the file.
5. Transmit the revised reproducible (it can be paper, they will just scan it) to Road Design attn: Marcus Lamar with a cc: to the roadway project manager (see sample letter in Appendix A) for inclusion in the electronic record set.

1.4.23 Files for Completed Projects

Once a bridge project has been constructed and accepted by the Department, the design file is condensed and should be prepared for transmittal to the Office of Maintenance (or to the bridge liaison for consultant contracts).

1. Remove all staples and clips.
2. Remove (or provide reduced size copies of) all sheets that are not 8½” x 11” or 8½” x 14”.
3. Remove all quantity calculations and non-essential correspondence.
4. Be sure all items are arranged in the file in the proper location and order.
5. If the boring log location sketch in the BFI is on plan size sheets, remove it from the file. Otherwise, include it with the BFI.
6. Include pile driving logs and load test reports. Include as-built foundation data if it is on 8½” x 11” or 8½” x 14” pages.
7. Include the Hydraulic Study (unless it has been given to Bridge Hydraulics) and any permits, if applicable.
8. Keep only enough of each computer program output to allow the program to be recreated. Keep geometry program input only if the bridge has unusual geometry. Don’t include reinforcing bar program input or output.
9. A CD with all pertinent electronic files should be kept on record as well.

It will be the responsibility of the Design Group Leader to determine what correspondence will be kept. Generally, if it is something you would want to have if there was a problem with the bridge or if you were widening the bridge, keep it. Do not keep shop drawing transmittal letters (going either way) unless they contain details or information that would be needed.

Appendix A - Sample Letters

The following pages contain copies of sample letter that are typically used on bridge projects.

You can find electronic versions of these letters on the Department's web site:

http://wwwb.dot.ga.gov/dot/preconstruction/bridgedesign/letters/index.shtml

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

INTERDEPARTMENT CORRESPONDENCE

FILE **BRST-030-1(25), Stewart County**
SR 27 over Bladen Creek
P.I. No. 333160

OFFICE Atlanta

DATE August 1, 2005

FROM Paul V. Liles, Jr., State Bridge Design Engineer

TO Randall L. Hart, State Construction Engineer
Attention: Melissa Harper

SUBJECT **COFFERDAM DETERMINATION REQUEST**

Attached for review please find one copy of the Bridge Plan and Elevation for the above referenced project. Also attached is a copy of the approved BFI. The two-year flood stage for the referenced project is Elev. 314.42. Please review and forward comments to this office in the next two weeks so that we can submit plans to Engineering Services for a Final Field Plan Review.

If you have any questions or require further information please call Ted Cashin at 404-463-6265.

PVL:EJC

Vance C. Smith, Jr., Commissioner

DEPARTMENT OF TRANSPORTATION

One Georgia Center, 600 West Peachtree Street, NW
Atlanta, Georgia 30308
Telephone: (404) 631-1000

January 29, 2009

BRST-030-1(25) STEWART
SR 27 over Bladen Creek
P.I. No. 333160-

FROM: Paul V. Liles, Jr., P.E., State Bridge Design Engineer

TO: Southern Concrete
P.O. Box 711
733 Liberty Expressway
Albany, GA 31702

SUBJECT: PRESTRESSED BEAMS

[X] Enclosed, bearing our Stamp of Approval, are your shop drawings.

[ ] These shop drawings contain our Review Comments showing corrections noted thereon.

[ ] These drawings bear our Stamp of Review.

[X] Please forward prints of the drawings to the fabricator.

[ ] Please furnish this office with ________ sets of these drawings for our further handling and distribution.

[ ] Please furnish this office with ___sets of corrected drawings for our further review and approval.

PVL:EJC
cc: District 3 Engineer, Thomas Howell
Area 2 Engineer (w/ approved shop drawings)
Andy Lindsey
1557 E. Lamar Street
Americus, GA 31709
Georgene Geary, attn: Jeff Carroll (w/ two sets of approved shop drawings)

Vance C. Smith, Jr., Commissioner

DEPARTMENT OF TRANSPORTATION

One Georgia Center, 600 West Peachtree Street, NW
Atlanta, Georgia 30308
Telephone: (404) 631-1000

January 29, 2009

BRST-0964(8) JONES CO.
SR 18 over Walnut Creek
P.I. No. 343400

FROM: Paul V. Liles, Jr., P.E., State Bridge Design Engineer

TO: Rogers Bridge Company, Inc.
1800 Briarcliff Road, NE
P.O. Box 15517
Atlanta, GA 30333

SUBJECT: BEARING PAD SHOP DRAWINGS

[X] Enclosed, bearing our Stamp of Approval, are your shop drawings.

[ ] These shop drawings contain our Review Comments showing corrections noted thereon.

[ ] These drawings bear our Stamp of Review.

[X] Please forward prints of the drawings to the fabricator.

[ ] Please furnish this office with ________ sets of these drawings for our further handling and distribution.

[ ] Please furnish this office with __ sets of corrected drawings for our further review and approval.

PVL:EJC
cc: District 3 Engineer, Thomas Howell
Area 4 Engineer (w/ approved shop drawings)
Brink Stokes
4499 Riverside Drive
Macon, GA 31210
Georgene Geary, attn: Kevin Ledford (w/ two sets of approved shop drawings)

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

INTERDEPARTMENT CORRESPONDENCE

FILE **BRST-030-1(25), Stewart County**
SR 27 over Bladen Creek
P.I. No. 333160

OFFICE Atlanta

DATE August 1, 2005

FROM Paul V. Liles, Jr., State Bridge Design Engineer

TO Thomas Howell, District Engineer, Thomaston
Attention: David Millen

SUBJECT **BRIDGE SITE INSPECTION AND STAKE OUT REQUEST**

Attached for your use please find copies of the bridge preliminary layout and the roadway typical section. Please perform a bridge site inspection and stake out the clearance between the endrolls and creek banks. Please send the results of the site inspection, in writing, to this office. The 2 year floodstage elevation is 483.78 feet. This bridge is on new alignment to the West of the existing roadway.

If you have any questions or require further information please call Ted Cashin at (404)463-6135.

PVL:EJC

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

INTERDEPARTMENT CORRESPONDENCE

FILE	**BRST-030-1(25), Stewart County** SR 27 over Bladen Creek P.I. No. 333160	OFFICE DATE	Atlanta August 1, 2005

FROM Paul V. Liles, Jr., State Bridge Design Engineer

TO David Crim, State Maintenance Engineer
Attention: Ben Rabun

SUBJECT **OVERSIZED TRUCK**

54 in. Bulb Tee PSC Beams are to be used on the above project. The beams are approximately 100 feet long and weigh approximately 68,650 lb. each. The total weight of the truck and beam will be approximately 113,650 lb.

Please let us know if there are acceptable shipping routes from the fabricator's plant to the project site. This project is scheduled for a December, 2002 letting.

If you have any questions or require further information please call Ted Cashin at (404)463-6135.

PVL:EJC

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

INTERDEPARTMENT CORRESPONDENCE

FILE **BRST-030-1(25), Stewart County**
SR 27 over Bladen Creek
P.I. No. 333160

OFFICE Atlanta

DATE August 1, 2005

FROM Paul V. Liles, Jr., State Bridge Design Engineer

TO Brent Story, State Road and Airport Design Engineer
Attention: Marcus Lamar

SUBJECT **AS-BUILT BRIDGE FOUNDATION PLANS**

Attached for revision to the electronic record set please find one full-size print of the as-built foundation sheet. This sheet reflects actual conditions encountered during construction as relayed by the DOT project engineer.

If you have any questions or require further information please call Ted Cashin at (404)463-6135.

PVL:EJC

cc: Geotechnical Bureau (half-size)
State Bridge Maintenance Engineer (half-size with P&E sheet)
Bridge Design, Hydraulics (half-size with P&E sheet and BFI)

NORFOLK SOUTHERN CORPORATION
OVERHEAD GRADE SEPARATION DATA SHEET

1. Location: ________________ ________________ Georgia
City County State

2. Distance from nearest Milepost to Centerline of Bridge: ________________________

3. State Project Number: ____

4. Description of Project: ____

____

____

____

5. Utilities on Railroad Property:

Name	Any Adjustments required?	Contact Person

6. List all the at-grade crossings that will be eliminated by the construction of this grade separation.

DOT#	Milepost	Signalized?

7. Minimum Horizontal Clearance from Centerline of Nearest Track to Face of Pier?

A. Proposed: __________________ B. Existing (if applicable): ______________

8. Minimum Vertical Clearance above top of high rail:

A. Proposed: __________________ B. Existing (if applicable): ______________

NORFOLK SOUTHERN CORPORATION
OVERHEAD GRADE SEPARATION DATA SHEET

Page 2

9. List piers where crashwalls are provided:

Pier:	Distance from centerline of track:
____________________	____________________
____________________	____________________
____________________	____________________

10. Describe how drainage from approach roadway is handled:

____

____

____

11. Describe how drainage from bridge is handled:

____

____

____

12. List piers where shoring is required to protect track:

____

____

____

13. Scheduled letting Date: ______________________________

NOTE: Design Criteria for Overhead bridges apply to Items 7 through 12.

All information on this Data Sheet to be furnished by Submitting Agency and should be sent with initial transmittal of project notification.

Vance C. Smith, Jr., Commissioner

DEPARTMENT OF TRANSPORTATION

One Georgia Center, 600 West Peachtree Street, NW
Atlanta, Georgia 30308
Telephone: (404) 631-1000

November 8, 2004

BRST-0000-00(0) Appling County
SR 1 over CSX Transportation, Inc.
P.I. No. 0000000

Mr. Les Scherr
Principle Manager, Public Engineer
CSX Transportation, Inc.
500 Water Street, J-301
Jacksonville, FL 32202

Dear Mr. Scherr:

This is to request permission for the Department of Transportation's equipment and personnel to enter upon Railroad Right-of-Way for the purpose of making test borings to determine foundation requirements for the bridge as shown in the preliminary layout transmitted with our letter of _____________________ in accordance with the following conditions:

(1) Drilling to be performed only during daylight hours with test borings not more than 4 inches in diameter and not nearer than 15 feet from centerline of track.

(2) The Department will furnish the Division Engineer of the Railroad in Atlanta, Georgia, sufficient advance notice so that Railroad supervision can be provided.

(3) At the completion of the test borings, the Department will promptly and completely fill-in and tamp and, in all respects, restore the right-of-way to its original condition, satisfactory to the Division Engineer of the Railroad.

(4) Permission extended shall be subject to termination upon five days notice in writing from either party to the other.

Subject to terms and conditions indicated above being satisfactory, please indicate your approval by signing and returning the original of this letter and retaining a duplicate of the original for your records.

Yours very truly,

Paul V. Liles, Jr., P.E.
State Bridge Engineer

PVL:

cc: Assistant State Bridge Engineer,
attn:
Georgene Geary, State Materials and Research Engineer,
Attn: Tom Scruggs

Approved and agreed to this ____ day of _____________, 20__

CSX TRANSPORTATION, INC.

By: ________________________

Title: ________________________

CSX OVERHEAD BRIDGE CROSSING DATA

1. Location: ______________ ______________ Georgia

City County State

2. Railroad Division: ____

3. Railroad Valuation Station at Centerline of Bridge: ________________________

4. Distance from nearest Milepost to Centerline of Bridge: _____________________

5. DOT Crossing Number: ____

6. State Project Number: ____

7. Description of Project:

____

____

____

8. Minimum Horizontal Clearance from Centerline of Nearest Track:

A. Proposed: __________________ B. Existing (if applicable): _________________

9. Minimum Vertical Clearance above top of low rail:

A. Proposed: __________________ B. Existing (if applicable): _________________

10. List piers where crashwalls are provided:

Pier: Distance from centerline of track:

_________________________ _______________________

_________________________ _______________________

11. Describe how drainage from bridge is handled:

____

____

12. List piers where shoring is required to protect track:

____

13. Plan Submittal: Preliminary ______________ Final ___________________

NOTE: CSX Criteria for Overhead bridges apply to Items 8 through 13.

2 General Design Data

2.1 Design Specification/Method

All Design shall be in accordance with the AASHTO Standard Specifications for Highway Bridges, 17^{th} Edition –2002, and the Georgia Standard Specifications, 2001 Edition, as modified by contract documents. LRFD specs shall be used if the Preliminary Engineering funds for the project are authorized in FY 2008 or later. If a project is not identified as a LRFD project on the preliminary layout it will use the 17^{th} Edition specs.

Structures involving curved steel members or steel boxes shall also be investigated using the AASHTO Guide Specifications for Horizontally Curved Bridges, 1993.

When designing pedestrian overpass structures, refer to the AASHTO Guide Specifications for Design of Pedestrian Bridges. Also, note that ADA requirements require that no grade be steeper than 1:12 (8.33%).

2.2 Loads

2.2.1 Dead Loads

In addition to those specified in AASHTO:

Metal Stay-In-Place (SIP) forms: 16 lbs./ft^2

Future Wearing Surface: 30 lbs./ft^2 – All Bridges

The noncomposite dead load will consist of the slab, the coping, the diaphragms, and the allowance for metal stay-in-place deck forms.

The composite dead load will consist of the sidewalks, barriers, parapets, medians, future paving allowance, and utilities. These loads will be summed and distributed equally to all beams except in the case of very wide bridges (over 70 feet out-to-out). For bridges wider than this, the sidewalk, barrier, and parapet loads should be distributed to the four exterior beams on each side, and the median load distributed to the beams under the median. The future paving allowance will be distributed to all beams.

2.2.2 Live Loads

Design Vehicular Load:

AASHTO HS-20 and/or Alt. Military Loading (minimum – all bridges)

The live load will be the AASHTO HS-20 live load including impact distributed a per the AASHTO Specification Distribution Factors. Distribution factors for deflection shall be calculated by multiplying the number of whole 12-foot lanes that will fit on the bridge by 2 and dividing by the number of beams. The distribution factor should not be less than 1.

When an existing bridge is to be widened, its structural capacity will be accepted if the live load capacity is HS 15 or greater. For bridges that are to be widened on the State Grip System, the structural capacity will be accepted if the live load capacity is HS-20 or greater.

The sidewalk live load will be calculated according to the AASHTO Specifications and distributed the same as the sidewalk dead load.

2.2.3 Seismic Loads

Bridges shall be designed for Seismic Category A except for bridges in the portion of Georgia where the Acceleration Coefficient is greater than 0.09, where bridges shall be designed for Seismic Category B. See Figure 2.2.3.

When a project calls for widening a bridge in a Category B region where the existing structure was originally designed for Category A, the widened portion shall be designed for Category B.

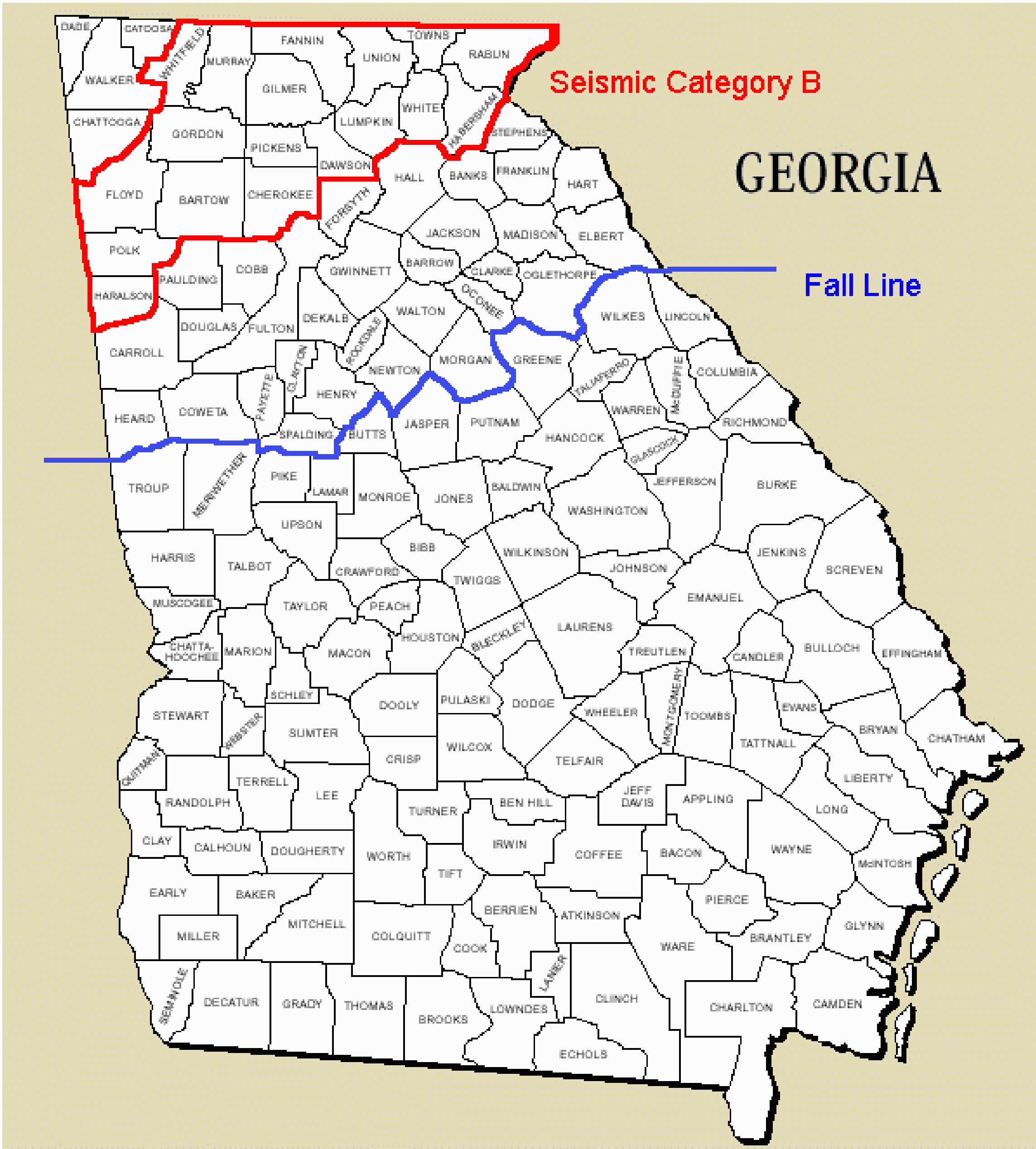


Figure 2.2.3

2.3 Horizontal & Vertical Clearances

All vertical and lateral clearances for bridge sites shall be determined by mathematical calculation and checked with an independent calculation.

2.3.1 Stream Crossings

See the GDOT Drainage Manual chapter 14.

2.3.2 Grade Separations

Vertical:

State Routes and Interstates -
The minimum vertical clearance from the bottom of superstructure to the roadway below shall be 16’-6”, with 16’-9” being the desired clearance (check with Bridge Design for clearance over interstates; often the desirable is 17 feet), except for any structure that cannot easily be jacked such as concrete boxes or bridges with integral piers which shall be designed for a minimum clearance of 17’-6”.

Rural Secondary and Urban system-
A minimum vertical clearance of 14’-6” is permissible, provided that a suitable bypass exists for tall vehicles.

Pedestrian bridges shall provide 17’-6” of vertical clearance over roads.

Where falsework is necessary, the above vertical clearances shall apply to the falsework construction.

Horizontal:
Follow the Clear Zone requirements as follows:

Whenever practical, intermediate bents shall be located so as to provide the desirable clear zone as specified in the AASHTO Roadside Design Guide. Where this is not practical, the designer shall coordinate with the Project Manager to determine where guardrail may be set to protect the columns. The face of the column shall be at least 5’-0” (1500 mm) behind the face of the guardrail to allow for the deflection of the guardrail.

2.3.3 Railroad Crossings

The minimum clearances over and around Railroads are as follows:

CSX Transportation, Inc.

1. Minimum vertical clearance of 23’-0” from top of high rail to bottom of beam. This clearance is measured along lines concentric with the centerline of the track and 10’-0” on either side.
2. The desirable horizontal clearance from center of track to the face of the column is 25’-0” on each side, and this should be provided whenever possible. Where multiple tracks are present, measurements are from the outermost tracks. This allows the intermediate bents adjacent to the railroad to be built without crash

walls. The minimum clearance is 18’-0” for tangent tracks. Add 3½” of clearance for each inch of track superelevation on curved tracks.

3. Crash walls are to be provided where horizontal clearance is less than 25 feet. The top of the crash wall should be 6’-0” above the top of the high rail. The crash wall should be 2’-6” in thickness and extend 2’-6” beyond the outside faces of the exterior columns. The face of the crash wall on the track side should be 6” inside the face of the column.
4. Existing drainage facilities parallel to the track(s) must be maintained through the structure.
5. Endrolls shall have slope paving.
6. Overpass drainage must be directed away from the railroad right-of-way.
7. See Figure 2-01 for railroad cross-section data for use in calculating bridge end locations. Allow 4’-9” for the depth of the ditch from top of rail to bottom of ditch. Please note, that this work may never actually be done depending on the existing conditions, but the proposed bridge length shall be determined using figure 2-01.

These items must be adhered to as closely as possible. Some items may be changed on a negotiated basis where conditions permit.

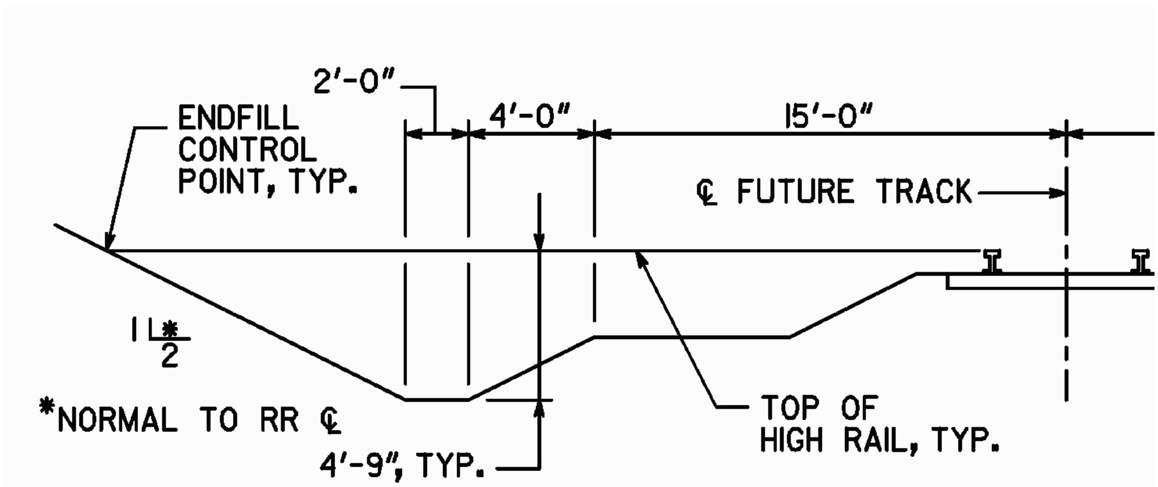


Figure 2.3.3 Endfill Control Diagram

Norfolk Southern Corporation (Subsidiaries of Norfolk Southern Corporation include Norfolk Southern Railway; Central of Georgia Railroad; Georgia Southern & Florida Railway; Tennessee, Alabama & Georgia Railway; Georgia Northern Railway; and Alabama Great Southern Railroad.)

1. Minimum horizontal clearance from center of track to the face of the column: 18 feet on one side and 14 feet on the other side of the track for locations where the span adjacent to the span over the railroad is not the end span. If the span adjacent to the railroad is the end span, provide 22’-0”. The railroad will advise which side requires the 18 feet based on the location and the direction of mechanized maintenance machinery. For double tracks, provide 18 feet on each side. In order to avoid the use of crashwalls, 25’-0” of horizontal clearance should be provided whenever possible.

2. Minimum vertical clearance of 23’-0” from top of high rail to bottom of beam. This clearance is measured along lines concentric with the centerline of the track and 10’-0” on either side.
3. Endrolls shall have slope paving.
4. Overpass drainage must be directed away from the railroad right-of-way.
5. Crash walls shall be provided if the horizontal clearance is less than 25’-0”. Crash walls should be 2’-6” in thickness and extend 2’-6” beyond the outside edge of the exterior column. The face of the crash wall on the track side should be 6” inside the face of the column. The top of the crash wall should be 10’-0” above the top of the high rail.
6. See Figure 2-01 for railroad cross-section data for use in calculating bridge end locations. Allow 4’-9” for the depth of the ditch from top of rail to bottom of ditch. Please note, that this work may never actually be done depending on the existing conditions, but the proposed bridge length shall be determined using figure 2-01.

See MOG 6865-7 concerning procedures for determining accurate vertical clearances over railroad tracks during construction.

2.4 Surveys for Bridge Design

NOTE: This is a guide for designers to assure that the survey includes all the information that they will need. Surveyors should be directed to the GDOT survey manual available from the Office of Environment and Location for more detailed information.

2.4.1 Stream Crossings - Hydraulic Studies

The following items are needed on a BRIDGE SURVEY WHICH IS OVER A STREAM:

2.4.1.1 Property Survey

A Property Survey that covers extents of the topographic corridor and stream traverse. As a minimum, this will include property owner's names and addresses, deeds, plats, and tax maps. The right-of-way should always be verified by deeds.

2.4.1.2 Existing Roadway Data

Alignment – The alignment of the existing roadway and bridge should be surveyed to the extents of the project limits. The beginning and ending centerline station should be established on the ground or pavement along with the beginning and ending centerline stations of the bridge and any PC's or PT's.

Profile - The profile of the existing roadway and bridge shall be determined for the same extents as the alignment. This profile shall include shots along the centerline, edges of pavement, outside edges of the roadway shoulder, and toe of the roadway embankment.

Intersecting roads - Profiles are required for all intersecting roads that are located within the limits of the floodplain. These profiles shall extend 500 feet upstream and/or downstream of the intersection with the project road.

Note: This data is also required for roadway and railroad embankments located along the stream and within the floodplain that are no further than 2000 feet upstream and/or downstream of the project site.

2.4.1.3 Existing Bridge Data

For bridge replacement and paralleling projects, top of deck shots at the beginning and end of bridge at the intersection of the Back Face Paving Rest (BFPR) with the centerline and gutter lines are required (see "Example A" in Widening section).

For bridge widening projects, in addition to the begin and end of bridge deck shots, top of deck shots are also required at the centerline of bents and at mid-spans along the centerline of the bridge and gutter lines (see “Example A” in Widening section). Bottom of beam elevations for the outside beams at each bent shall be obtained.

Note: The above data shall be provided for all bridges or culverts located within the floodplain that are no further than 2000 feet upstream and/or downstream of the project site.

For bridge widening projects where the existing bridge plans are not available, a more detailed survey that gives a complete description of the superstructure and substructure will be required. Surveyor shall check with Project Engineer to determine availability of bridge plans.

2.4.1.4 Topographic Coverage

Topographic coverage shall extend at least 150 ft each side of the centerline. These coverage limits shall apply to both the existing centerline and proposed centerline, if different.

Note: It is preferred that the hydraulic survey data be taken in DTM format. The coverage shall be detailed enough to cover all required areas specified in the field report. These survey points should be included in the CAiCE file that is provided to the project engineer. All survey points should be labeled consistently and clearly identified. ALL SURVEY DATA SHALL BE REFERENCED TO NGVD.

2.4.1.5 Benchmarks

Three benchmarks are required: One at the beginning of the survey, one at the bridge or stream site near the right-of-way, and one at the end of the survey. These three benchmarks should be described with a sketch, which also shows the X, Y, and Z coordinates. Benchmarks shall be referenced to the project stations with a complete physical description and elevation. All elevations should be established with a spirit level, referenced to NGVD.

2.4.1.6 Stream Traverse

The stream traverse should begin at 500 feet upstream from the bridge centerline with Station 1+00.00 and then continue downstream to a station 500 feet below the bridge centerline. Cross sections of the stream channel are required underneath the existing bridge and at the centerline of the proposed bridge site, if different. Cross sections of the stream channel are required at 50 feet and 100 feet upstream and downstream of the proposed bridge centerline. Additional cross sections are required at 100-foot intervals along this traverse. These cross sections shall be detailed enough to accurately define the profile of the terrain, which usually includes end rolls, stream channel banks, streambed elevations, scoured areas, and any other breaks in the terrain (see Figure 2 at the end of this section). A sufficient number of streambed shots shall be taken to insure an accurate stream channel model can be created. **Traverses and stream cross sections shall be provided for all stream channels in the floodplain.** As stated above, the DTM method is preferred, as long as it is detailed enough to accurately define the location and cross section profile of the stream channel 500 feet upstream and downstream of the proposed bridge site.

2.4.1.7 Floodplain Cross Sections

Two floodplain cross sections are required and should extend to a point 2 feet above the high water mark that has been established for the stream at the bridge site. The floodplain elevations are to be taken at 100 feet on each side of the roadway. When floodplain cross sections extend past the Bridge Survey alignment, the floodplain cross sections should be taken at 500 feet intervals until the 2 feet above high water floodplain has been reached.

Parallel bridge projects and/or projects with the proposed alignment shifted a relatively small distance require a floodplain cross section be taken along the new and/or parallel alignment.

New location projects require that a floodplain cross-section be taken along the new alignment.

For projects with Abnormal Flood Conditions (Creeks that flow into one of the State's Major Rivers), a floodplain cross section is required of the Major River below the confluence with the creek. Since this would be an extremely costly section to have surveyed, this Cross Section may be approximated from USGS maps.

Note: This data is also required for bridge and roadway sites located along the stream that are no further than 2000 feet upstream and/or downstream of the project site.

2.4.1.8 Bridge Sketch

Bridge sketches shall be drawn showing the elevation and centerline plus the bottom of the bridge beam at each cap. This sketch also shows the centerline station plus an elevation on all terrain breaks beneath the bridges. The stationing used to show elevations on the bottom of the beam and the profile of the ground beneath the lowest bridge beam shall be the same as the stationing for the alignment of the bridge deck. On mapping surveys, which have no alignment, the stationing for the bridge sketch shall begin with station 0+00. For structures located upstream or downstream that could have an adverse affect of the bridge at the survey site, a sketch is required. This distance could be as much as 2000 feet. For upstream drainage structures beyond this limit, the size and type should be plotted on a quadrangle map or county map.

2.4.1.9 Overflow Bridges or Culverts within Floodplain

A distance from the bridge being surveyed to any overflow bridge or culvert that is within it's floodplain should be shown along with a bridge sketch, the elevation of the deck or size of the culvert and the flow line elevation.

2.4.1.10 Hydraulic Field Report

The surveyor will also provide a Hydraulic Field Report in accordance with Georgia Department of Transportation Standards. See the attached Form.

2.4.1.11 Normal Water Surface Data

Water surface elevations are required at the survey centerline, and at 500 feet upstream and downstream of the survey centerline. These shots shall be taken in the same time period.

For tidal sites the normal high and low tide elevations are required.

2.4.1.12 Historical Flood Data

The extreme high water elevation (flood of record) shall be obtained along with the date of occurrence, location (upstream or downstream face of the bridge, distance upstream, downstream, or at the centerline), and the source for this information. If the site is tidal, then the highest observed tide elevation is needed.

The floor elevations and locations of any houses, buildings or any other structures that have been flooded, or have floor elevations within 2 feet of the flood of record. For buildings/structures that have been flooded, the information about the flood shall be provided. This information includes the number of times the structure has been flooded, the date(s), and the high water elevations.

Note: The high water elevations should be obtained from longtime local residents and/or city/county officials.

2.4.1.13 Miscellaneous Survey Data

Dams and Spillways **-** For sites affected by an upstream or downstream dam, survey shots are required that describe the location, length, width and elevation of the dam embankment and spillway opening. The water surface elevation of the impounded water shall be provided.

Guide Banks (Spur Dikes) - Shots shall be taken that will reflect the location, length and elevation of the guide bank.

Longitudinal Roadway Encroachments on Floodplains - Additional floodplain cross sections will be required to determine the effects of the longitudinal encroachment. **The surveyor can contact the Project Engineer for guidance on the extent of additional survey data that will be required.**

Upstream and Downstream Crossings – For all bridges and culverts that lie between 2000 feet and 1 mile upstream and downstream from the project bridge, the surveyor shall identify basic information for each structure such as distance from proposed structure, type of structure, route location, and structure sizes in the hydraulic engineering field report.

If the hydraulics at the project site is affected by other factors such as confluence with other streams, and/or narrow floodplain cross sections, additional floodplain cross sections may be required. **The surveyor should contact the Project Engineer if a question arises during the field survey of the project.**

HYDRAULIC ENGINEERING FIELD REPORT

I.HYDRAULIC AND HYDROLOGICAL DATA REQUIRED FOR ALL EXISTING OR PROPOSED BRIDGE STREAM CROSSING PROJECTS

A. Project Location

District____________ County____________ Project No.____________________

P.I. No.____________ Route____________ Stream Name__________________

Surveyed By________________________ Date________________________

B. Site Information

Floodplain and Stream Channel description:

1. Flat, rolling, mountainous, etc.____________________________________
2. Wooded, heavily vegetated, pasture, swampy, etc.______________________
3. Stream channel description: well-defined banks, meandering, debris, etc.____
4. Is there any fill in the upstream or downstream floodplain, which will affect the natural drainage or limit the floodplain width at this site?__________

C. Required Existing Bridge Information at Project Site

Bridge Identification No. ____
Date Built ____
Skew angle of bridge bents____
Substructure Information:
Column type (concrete, steel, etc.)________________________________
Size of column ____
Number of columns per bent______________________________________
Height of curb, parapet or barrier __________________________________
Guide Bank (Spur Dike) length, elevation and location (if applicable)__________

Note any scour problems at intermediate bents or abutments: ____________

D. Normal Water Surface Data

	WS ELEV
500 feet upstream of the survey centerline	____________
At the survey centerline	____________
500 feet downstream of the survey centerline	____________
Normal high tide	____________
Normal low tide	____________

E. Historical Flood Data

Extreme high water elevation at site __________ Date ______________________
Highest observed tide elevation __________ Date ______________________
Location where extreme high water elevation was taken (upstream or downstream face of bridge, distance upstream or downstream, centerline)
Source of high water information ______________________________________

____

Location and floor elevation of any houses/buildings/structures that have been flooded. ____

____

Information about flood (number of times house/building/structure has been flooded, water surface elevation(s) and date(s) of flood ______________

____

Location and floor elevation of any houses/buildings/structures that have floor elevations within 2 feet of the extreme high water elevation ____________

____

F. Benchmark Information

Benchmark number ____
Location (CAiCE pt. no. or project station/offset) ______________________
Physical description ____

____

Benchmark number ____
Location (CAiCE pt. no. or project station/offset) ______________________
Physical description ____

____

Benchmark number ____
Location (CAiCE pt. no. or project station/offset) ______________________
Physical description ____

____

G. UPSTREAM AND DOWNSTREAM STRUCTURES

Structure type (railroad or highway bridge, culvert) ______________________
Route number (if applicable) ____
Distance from proposed structure ____
Length of bridge or culvert size ____
Substructure information: ____
Column type (concrete, steel, etc.) _______________________________________
Size of column ____
Number of columns per bent ____

Note: The above information is required for all bridges or culverts, which lie between 2000 ft and 1 mile upstream or downstream of the project bridge.

H. MISCELLANEOUS INFORMATION

Are there water surfaces affected by other factors (high water from other streams, reservoirs, etc.)? ______________________________

Give location, length, width, and elevation of dam and spillway, if applicable ______

____

2.4.2 Grade Separations

The following items are needed for a BRIDGE SURVEY OVER AN EXISTING ROAD:

2.4.2.1 Property Survey

A Property Survey that covers extents of all of the roadway alignments' corridors. As a minimum, this will include, property owner's names and addresses, deeds, plats, and tax maps. The right-of-way should always be verified by deeds.

2.4.2.2 Existing Roadway Data

Alignment - The alignment of the existing roadway and bridge should be surveyed to the extents of the project limits**.** The beginning and ending centerline station should be established on the ground or pavement along with the beginning and ending centerline stations of the bridge and any PC's or PT's.

Profile -The profile of the existing roadway and bridge shall be determined for the same extents as the alignment. This profile shall include shots along the centerline, edges of pavement, outside edges of the roadway shoulder, and toe of the roadway embankment.

Intersecting roads - Profiles are required for all intersecting roads that are located within the limits of the survey. These profiles shall extend at lease 300 feet from the intersection with the project road. These profiles shall include shots along the centerline, edges of pavement, outside edges of the roadway shoulder, and toe of the roadway embankment.

2.4.2.3 Existing Bridge Data

For bridge replacement and paralleling projects, top of deck shots at the beginning and end of bridge at the intersection of the Back Face Paving Rest (BFPR) with the centerline and gutter lines are required (see "Example A" at the end of the widening section).

For bridge widening projects, in addition to the begin and end of bridge deck shots, top of deck shots are also required at the centerline of bents and at mid-spans along the centerline of the bridge and gutter lines (see "Example A" at the end of the widening section). Bottom of beam elevations for the outside beams at each bent shall be obtained.

For bridge widening projects where the existing bridge plans are not available, a more detailed survey that gives a complete description of the superstructure and substructure will be required. Surveyor shall check with Project Engineer to determine availability of bridge plans

2.4.2.4 Topographic Coverage

Topographic coverage shall extend at least 150 ft each side of the centerline**.** These coverage limits shall apply to both the existing centerline and proposed centerline, if different.

2.4.2.5 Benchmarks

Three benchmarks are required: One at the beginning of the survey, one at the bridge site near the right-of-way, and one at the end of the survey. These three benchmarks should be described with a sketch, which also shows the X, Y, and Z coordinates. Benchmarks shall be referenced to the project stations with a complete physical description and elevation. All elevations should be established with a spirit level, referenced to NGVD.

2.4.2.6 Profile and Cross Sections

Profile and Cross Sections or DTM coverage should have the same limits as the Topographic limits.

2.4.2.7 Roadway Beneath Bridge

The road beneath a bridge for 300 feet left and right of the bridge requires a complete survey which includes: Alignment, property, topographic, profile levels and cross sections or DTM survey data.

2.4.2.8 Bridge Sketch

A bridge sketch is required. On this sketch it is important to show the vertical clearance from the bottom of the outside bridge beams to the roadway pavement at the centerline of the road and at each edge of pavement of the road.

2.4.3 Railroad Crossings

The following items are needed for a BRIDGE SURVEY OVER AN EXISTING RAILROAD:

2.4.3.1 Property Survey

A Property Survey that covers extents of the roadway alignment and railroad corridors. As a minimum, this will include, property owner's names and addresses, deeds, plats, and tax maps. The right-of-way should always be verified by deeds.

2.4.3.2 Existing Roadway Data

Alignment - The alignment of the existing roadway and bridge should be surveyed to the extents of the project limits. The beginning and ending centerline station should be established on the ground or pavement along with the beginning and ending centerline stations of the bridge and any PC's or PT's.

Profile - The profile of the existing roadway and bridge shall be determined for the same extents as the alignment. This profile shall include shots along the centerline, edges of pavement, outside edges of the roadway shoulder, and toe of the roadway embankment.

Intersecting roads - Profiles are required for all intersecting roads that are located within the limits of the survey. These profiles shall extend at least 300 feet from the intersection with the project road. These profiles shall include shots along the centerline, edges of pavement, outside edges of the roadway shoulder, and toe of the roadway embankment.

2.4.3.3 Existing Bridge Data

For bridge replacement and paralleling projects, top of deck shots at the beginning and end of bridge at the intersection of the Back Face Paving Rest (BFPR) with the centerline and gutter lines are required (see "Example A" at the end of the widening section).

For bridge widening projects, in addition to the begin and end of bridge deck shots, top of deck shots are also required at the centerline of bents and at mid-spans along the centerline of the bridge and gutter lines (see "Example A" at the end of the widening section). Bottom of beam elevations for the outside beams at each bent shall be obtained.

For bridge widening projects where the existing bridge plans are not available, a more detailed survey that gives a complete description of the superstructure and substructure will be required. Surveyor shall check with Project Engineer to determine availability of bridge plans

2.4.3.4 Topographic

Topographic coverage shall extend at least 150 ft each side of the centerline. These coverage limits shall apply to both the existing centerline and proposed centerline, if different.

2.4.3.5 Benchmarks

Three benchmarks are required: One at the beginning of the survey, one at the bridge or stream site near the right-of-way, and one at the end of the survey. These three benchmarks should be described with a sketch, which also shows the X, Y, and Z coordinates. Benchmarks shall be referenced to the project stations with a complete physical description and elevation. All elevations should be established with a spirit level, referenced to NGVD.

2.4.3.6 Profile and Cross Sections

Profile and Cross Sections or DTM coverage should have the same limits as the topographic limits.

2.4.3.7 Railroad Beneath Bridge

The railroad beneath the bridge for 500 feet left and right of the bridge requires a complete survey that includes:

Alignment – The alignment of the centerline on the main railroad tracks for 500 feet left and right of the bridge shall be surveyed. The intersection of the bridge alignment and the railroad alignment shall be tied to a railroad milepost.

Property survey – As described in section 2.4.2.1.

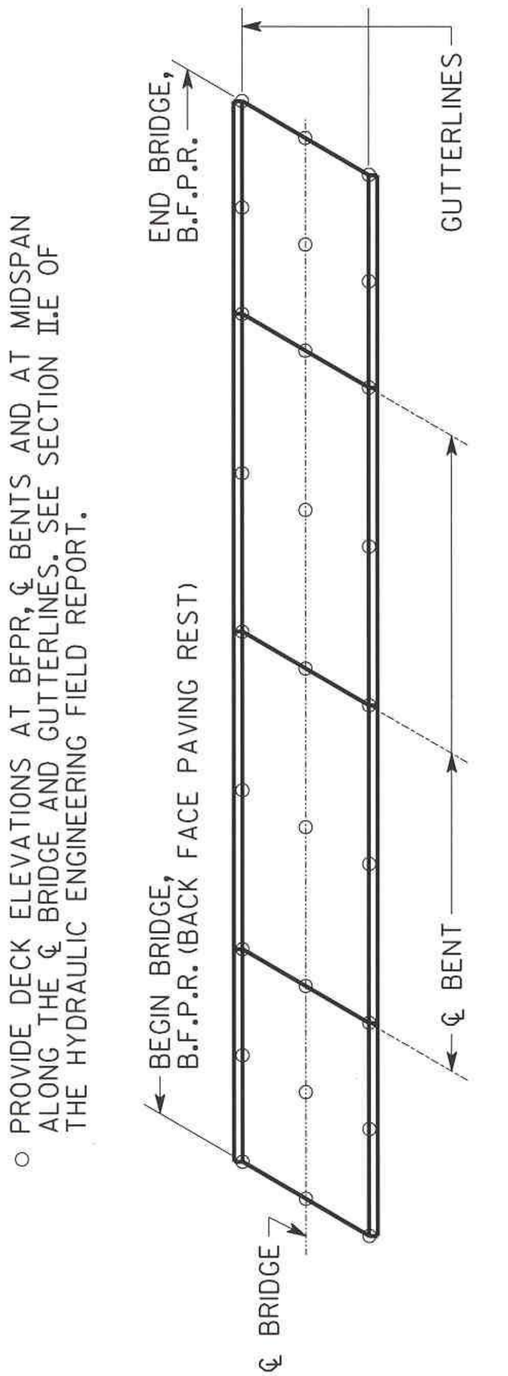
Topographic – The topographic coverage limit shall be 100 feet left and right on each side of the track. If the location has multiple tracks, coverage should be 100 feet beyond the centerline of the outermost track. The location of the existing bridge pilings should be located from the survey centerline.

Profile Levels and Cross Sections or DTM Survey Data – The profile and cross sections or DTM survey data shall be taken a minimum of 100 feet each side of the track. If the location has multiple tracks, coverage shall extend for 100 feet beyond the centerline of the outermost track. Elevations are to be taken on the top of each rail. If collecting elevations in the cross section format, a minimum of five (5) cross sections shall be taken between the proposed right-of-way limits. One at the proposed right-of-way, one halfway between the proposed right-of-way and the bridge centerline, one at the bridge centerline, and the same for the other side of the bridge. These cross-sections will be taken perpendicular to the railroad track centerline and extend for 100 feet beyond the centerline of the outermost track.

Drainage – All drainage structures and features within the 1000 feet Railroad Survey corridor shall be provided.

2.4.3.8 Bridge Sketch

A bridge sketch is required. On this sketch it is important to show the vertical clearance from the bottom of the outermost bridge beams to the top of the railroad rail for each rail beneath the bridge.

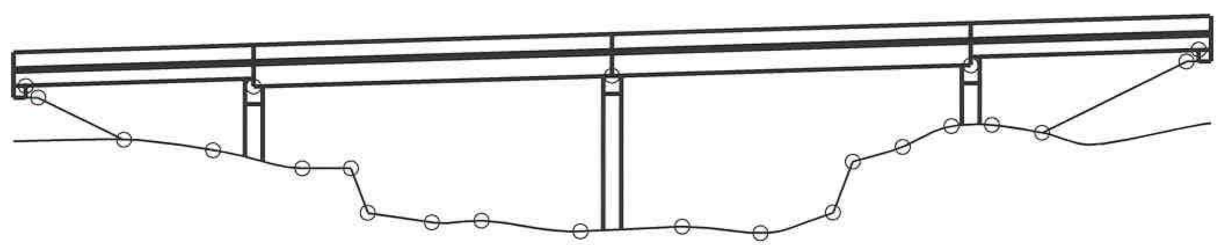


REQUIRED BRIDGE DECK ELEVATIONS

FIGURE I

○ REQUIRED BRIDGE OPENING SHOTS. SEE SECTION II.E OF THE HYDRAULIC ENGINEERING FIELD REPORT.

A SUFFICIENT NUMBER OF STREAMBED SHOTS SHALL BE TAKEN TO INSURE AN ACCURATE STREAM CHANNEL CROSS SECTION.

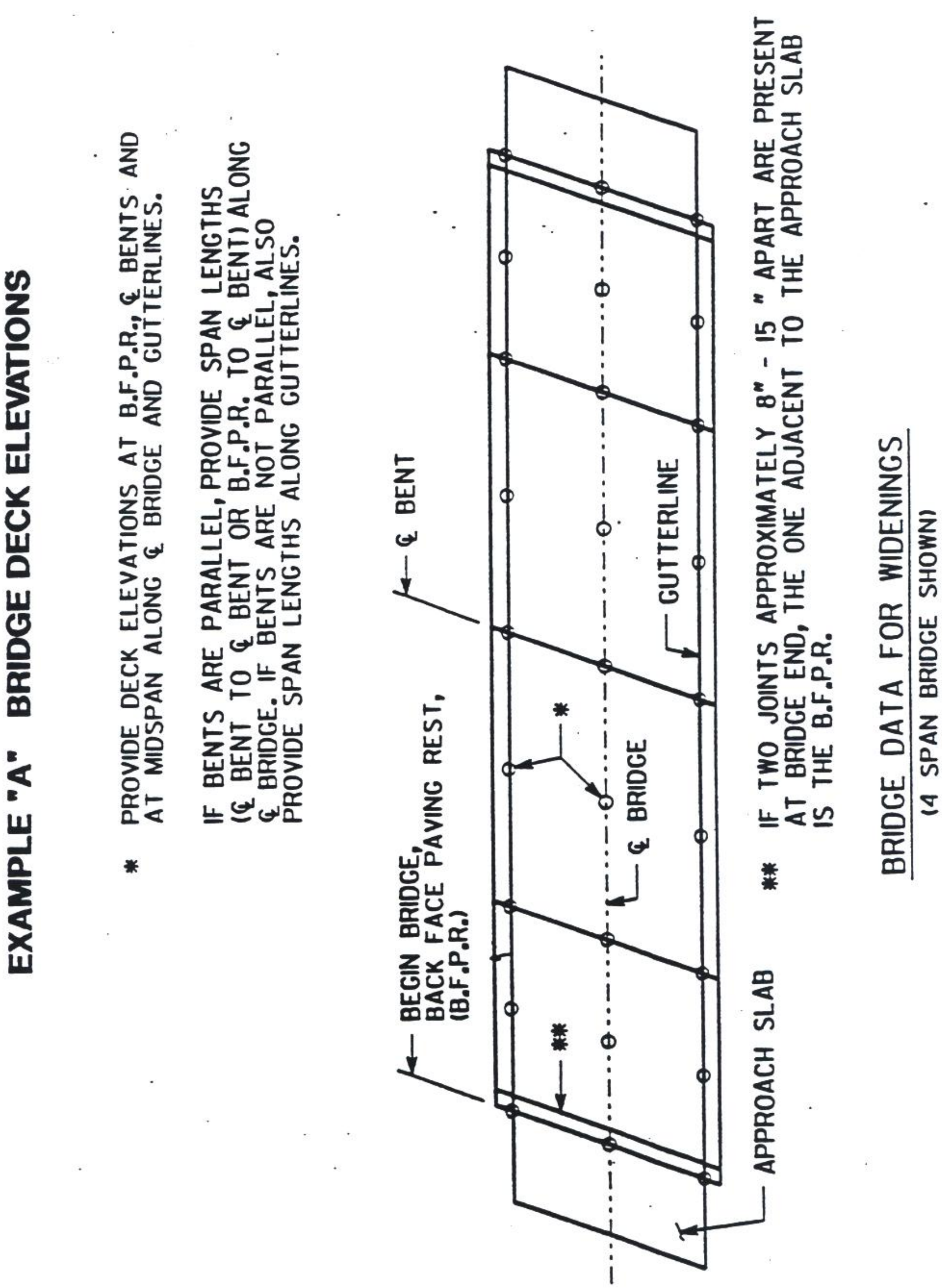


TYPICAL SECTION - PROFILE OF BRIDGE OPENING

FIGURE 2

2.4.4 Widening

Follow the same guidelines for the type of crossing as listed previously, but add the existing bridge deck elevations as shown in “Example A” from the GDOT survey Manual:



2.5 Staged Construction

When widening bridges, or at locations where expensive Right of Way, historical boundaries, or other obstructions require constructing the new bridge in nearly the same footprint as existing, staged construction may be required.

2.5.1 Temporary Shoring

Since it is difficult for designers to anticipate a contractor's exact method of construction, temporary shoring shall be shown wherever it is deemed necessary, but DO NOT include it as a pay item. Show the temporary shoring with a breakline at the end to indicate indefinite limits. If the shoring is shown on the plans, include a general note addressing the shoring or include temporary shoring in the list of incidental items. A common exception to this guideline would be where a cofferdam was determined as necessary by the Office of Construction. Substantial required shoring might require a separate pay item.

2.5.2 Pour Strips

Designs for Bridge Widenings and Staged Construction shall consider the need for pour strips, see Section 3.2.1 for Pour Strip details.

2.5.3 Temporary Barrier

Designs for Bridge Widenings and Staged Construction shall consider the need for Temporary Barrier, See Section 3.4.4 for Temporary Barrier Details.

2.6 Bridge Jacking

Where bridges are to be raised, the designer shall provide jacking details in his final construction plans. These details should provide 16'-9" minimum vertical clearance over the travel way and paved shoulders. This includes provision for any asphaltic concrete placement that may be part of the project.

The Liaison Engineer should contact the District Utilities Engineer during the developmental stage, and inform him that the bridge is to be raised and that he needs to ascertain through field site inspection which utilities are in place on the bridge and their location. He should then report his findings to the Bridge Office. The District Utilities Engineer further needs to alert the impacted Utility Companies to the proposal to raise the bridge and to remind them that the Utility Companies will be responsible for coordinating satisfactory utility realignment.

Additionally, a request should be made to the GDOT Bridge Maintenance Office for a Bridge Condition Survey. Items reported in need of repair or replacement should be incorporated into the contract documents if practical.

As a minimum, each set of bridge jacking plans should include a Plan and Elevation sheet and Jacking Details sheets sufficient to describe the overall scope of work and show the required GDOT Bridge Office details along with other pertinent data necessary to obtain accurate and competitive bids. These sheets are in addition to applicable Roadway sheets which would include the minimum Cover, Index, Revision Summary, Summary of Quantities, Detailed Estimate, Typical Sections, and Plan & Profile sheets.

The Plan and Elevation sheet should clearly show a plan view including as a minimum beginning and ending bridge stations, bent arrangements, deck widths, and the point of minimum vertical clearance. It should also clearly show an elevation view including as a minimum the length of bridge, span lengths, locations of expansion and fixed bearings, bent numbering, and the minimum vertical clearance at completion.

In addition to a bridge plan and elevation view, the P & E sheet should contain the following information:

- Information regarding the existing bridge formatted in accordance with the Bridge Office's standard "EXISTING BRIDGE CONSISTS OF" tabulation.
- A "UTILITIES" tabulation of all utilities.
- A "WORK CONSISTS OF" tabulation outlining the basic items of the work.
- A "DESIGN DATA FOR DESIGN OF PEDESTALS" tabulation indicating the design specifications used, the typical loading, and the future paving allowance assumed.
- A "CONSTRUCTION SEQUENCE" tabulation enumerating proposed steps necessary to complete the work. A note should be included immediately following these steps stating "The aforementioned sequence shall be coordinated with the roadway operations, see roadway plans. In lieu of the above sequence, the contractor may submit a proposed sequence for approval."
- A tabulation of current "TRAFFIC DATA" for the existing bridge.
- A "SUMMARY OF QUANTITIES" in standard Bridge Office format. This will typically include a lump item for raising the existing bridge, joint re-sealing items, and any other requested bridge rehabilitation items.
- Existing grade data for both the bridge and any underpass roadways.
- The existing bridge Serial, I.D., and P.I. numbers as well as a completed title block in the lower right corner of the sheet.

Some of the above items may be included on a separate General Notes sheet if necessary or the General Notes may be included with the Jacking Details. General Notes should include all applicable standard Bridge Office notes pertinent to bridge jacking operations. Additionally, the notes should address protection of existing slope paving, removal and replacement of existing bridge joints and/or other rehabilitative work, amount of jacking and vertical clearance to be obtained with reference to special provisions, and responsibility for utility disconnects/reconnects/adjustments.

Jacking Details sheets should include as a minimum the following:

- Section views at endwalls/backwalls detailing required modifications including pedestals, new concrete and reinforcement, and approach slab modifications.

- Schematics of utility adjustments.
- Schematic plan and elevation views of bearing assemblies and pedestals.
- Details of elastomeric bearings if required (may be shown on separate sheet if necessary).
- Details of wingwall modifications.
- Expansion joint details.
- Steel specifications and finish requirements.
- Details/requirements for anchor bolt replacement.

The engineer shall consider maintenance of traffic in the design and ensure adequate coordination with the roadway plans. The sequence of operations should limit differential grades at lift points to 1-inch or less at any given time or as indicated in the Special Provision for this work.

It is generally not necessary or desirable to specify a jacking method in the plans. The Special Provision for this work should contain the basic jacking requirements and the engineer should make sure that is the case. It is the intent that the contractor retains responsibility for the jacking method/details and damage to the structure. However, the engineer should fully consider all jacking loads to be placed on the structure. Members should be analyzed as necessary to ensure that adequate strength is available for jacking by conventional means. If not, special notes or details should be developed so a means and method is clearly available for bidding.

Conventional detailing for bridge jacking should include provisions for retaining existing approach slabs with modifications for re-supporting on the paving rest after jacking is complete. The existing approach slabs should normally be overlaid with permanent asphalt as the bridge is jacked thereby maintaining a consistent traffic surface that will remain in place at the completion of the project. Stipulations should be included in the plans to require the contractor to check for voids beneath the approach slab by sounding and coring prior to cutting it free of the paving rest. If voids are detected, they should be grouted with flowable fill per Specification Section 600 and a nominal quantity should be set up for this purpose to be used as directed by the engineer.

Concrete pedestals shall be specified unless the pedestal height is 1'-9" or less. Where the bridge is also being widened on each side in such a way that the existing portion of the bridge will be laterally restrained, concrete pedestals are required only when the pedestal height is over 2'-3"; pedestals lower than these limits may be steel.

2.7 Bridge Salvage

For all projects, the following procedure is established relative to materials to be salvaged from existing bridges when they are removed during the construction of a new or widened bridge:

1. In the Preliminary Layout stage, the Designer shall write a letter to the Office of Maintenance asking for a list of materials to be salvaged from the existing structure. The Office of Maintenance will then respond by letter either stating that nothing will be salvaged, or with a list of items to be salvaged.

2. The Designer shall place a note similar to the following on the Plans whenever existing bridge materials are to be removed from an existing site:

    Salvage of Structural Steel – All structural steel shall be salvaged for use by the Department of Transportation and shall be removed and stockpiled by the Contractor. The District Maintenance Engineer shall be notified and at a mutually agreeable time the salvaged material shall be loaded on DOT vehicles by the Contractor.

2.8 Software

The Bridge Design Office has a variety of programs available for design that fall into three categories: required, recommended, and optional.

Required software:

Required software must be used to at least check the final design of the appropriate items unless analysis of the structure is beyond the capacity of DOT programs:

1. Geometry (BRGEOM) – All bridges shall have a geometry program run showing the profile grade line, centerline construction, beam lines, gutter lines and edge of bridge. Transverse lines shall include end of bridge, centerline bents, centerline of bearing, and (for T-beams only) face of cap. This requirement may be waived for the very simplest of bridges.
2. Prestressed Beam (BRPSBM1) – All beams must analyze without overstress in the prestressed beam program. A run will be required for every different length or load condition.
3. Pier Program (BRPIER) – Each bent must have a pier program run. Seismic Performance Category B bridges are to be analyzed by BRNCPIER which provides input for seismic loads. There is no software required for pile bents.
4. Simple Span Beam (BRSPAN) – Required for simple span steel bridges. Note that the t-beam part of the program uses allowable stress and therefore is not required but can be helpful in generating loads.
5. Continuous Beam (BRCTBM) – Required for continuous steel beams.
6. General Notes (BRNOTES) – This is required to be run on each job so that you will have the correct notes and pay items. A text file can be produced using BRRUNOFF that can be inserted onto a sheet in the correct format.
7. Reinforcing Steel (BRRBAR) – Use this so that steel quantities will be calculated correctly and the rebar sheets will be correctly formatted. You can run other programs as a check. BRCONVERT makes the output usable in Microstation.
8. Slab Design (BRSLAB03) – You can either run this or use the latest slab charts. The design of the slab uses allowable stress design.

Recommended software:

1. Bearing Pad (BRPAD1) – Provide a run for each size of pad and for each load case or expansion case. No design is required for half-inch unreinforced bearing pads

2. SEISAB – For bridges in the seismic zone B. Use in conjunction with NCPIER.
3. DESCUS (BRDESC) – For curved steel girders

Optional software:

1. BRLLCA – Live load case program. Comes up with live load input for the pier program.
2. BRPCAC – PCA Column Analysis
3. BRCPFT – Continuous footing program
4. BRSIGN – Sign base
5. BRSPAN – GDOT simple span beam program
6. Merlin-Dash – Proprietary simple span or continuous beam program

2.9 Preliminary Design

The Preliminary Phase is where the basis or template for the Final Bridge Plans is set. Therefore it is critical for the designer to consider all the known aspects that may affect the bridge design and plan for them during this phase.

Early in the design process there can be some back and forth with the roadway designers to simplify the design and construction of the bridge. Generally bridges fall wherever needed to provide a favorable roadway alignment. However there are some exceptions.

Try to keep the low-point off of the bridge and approach slabs. If this is not possible at least try to keep it off of the end of the bridge where a joint is located and try to keep it off of the end spans where it would drain onto unprotected slopes. Also avoid placing the low point at an intermediate bent since we do not provide deck drains at intermediate bents. Also avoid a low point at an expansion joint. See section 3.5 for details.

Superelevation transitions on bridges should be avoided when practical. When a bridge carries two-way traffic, transitions between normal curve and reverse curve should particularly be avoided as this is very difficult to construct accurately and requires a longitudinal construction joint. When a transition must occur on the bridge, request that the Project Manager consider the following:

1. Transition to a certain point, then carry that superelevation rate across the bridge before continuing the transition.
2. When that cannot be done, and a transition between normal and reverse crowns is needed, increase or decrease the transition rate or locations of transition points to keep the normal to reverse crown transition off the bridge.

2.9.1 Bridge Widths

See http://wwwb.dot.ga.gov/topps/pre/bridge/4265tc.htm for the latest policy.

In terms of a GDOT bridge design, the first consideration is what type of roadway (Urban or Rural) will the bridge be carrying; this will help determine the proper bridge width and should be available from the Roadway Designer.

Once this is known, the bridge designer should determine the bridge width from the following charts, where TW is the traveled way (total width of lanes):

2.9.1.1 Bridges on the state and federal system (not interstate)

Rural section (2 lanes)

Speed Design	Design Year ADT	Bridge Width Clear Distance
All Speeds	0-399	4’ + TW + 4’
All Speeds	400-2000	6’ + TW + 6’
All Speeds	Over 2000	8’ + TW + 8’

Rural section (multilane undivided – 4 lanes or more): 8’ + TW + 8’

Rural section (multilane divided): 4’ (inside shoulder) + TW + 8’ (outside shoulder)

Urban sections (curbed)

The minimum clear width for all new or reconstructed bridges shall be the curb to curb width of the approaches except that the minimum curb to curb width for two-lane, two-way bridges shall be TW + 4 ft (1.2 m) unless an exception is obtained from the Chief Engineer. Sidewalks shall be provided on bridges where curb and gutter is provided on the approach roadway. Minimum sidewalk width on bridges shall be 5.5 ft (1.7 m). Minimum sidewalk width on bridges where sidewalks are provided on the approach roadway shall be approximately 5.5 feet (see Section 3.4.2 Sidewalks and Medians). The roadway curb and gutter section is 2’-6” of which 2’ is considered gutter for calculation of the bridge width.

Ramps

The width of bridges used on ramps shall be considered on a case by case basis. It is suggested that the designer consult with the GDOT PM and Bridge Office liaison to help determine the width of the bridge for a ramp.

2.9.1.2 Bridges off the state and federal system

Rural section (2 lanes without curb)*

Speed Design	Design Year ADT	Bridge Width Clear Distance
All Speeds	0-399	2’ + TW + 2’
All Speeds	400-2000	3’ + TW + 3’
All Speeds	Above 2000	8’ + TW + 8’

*For low volume roads with an approach roadway width of one lane, a minimum bridge width of 18 ft. may be selected with concurrence of the Chief Engineer.

Rural section (multilane undivided – 4 lanes or more): 8’ + TW + 8’

Rural section (multilane divided): 4’ (inside shoulder) + TW + 8’ (outside shoulder)

Urban section (with curb)

The minimum clear width for all new or reconstructed bridges shall be the curb to curb width of the approaches except that the minimum curb to curb width for two-lane, two-way bridges shall be TW + 4 ft (1.2 m) unless an exception is obtained from the Chief Engineer. Sidewalks shall be provided on bridges where curb and gutter is provided on the approach roadway. Minimum sidewalk width on bridges shall be 5.5 ft (1.7 m), 6 inches of which would be curb along the roadway.

2.9.1.3 Interstate Bridges

Lanes in One Direction	Bridge Width
Two Lanes	6’ (inside shoulder) + TW + 12’ (outside shoulder)
Three or More	10’ (inside shoulder) + TW + 12’ (outside shoulder)
Three or More with High Truck Traffic	12’ (inside shoulder) + TW + 12’ (outside shoulder)

The philosophy on shoulder widths is that with two lanes drivers should be able to take refuge on the outside shoulder. When more lanes are present they may have to take refuge on the inside shoulder. When there is high truck traffic additional width may be needed to allow trucks to take refuge on the inside shoulder.

If there is a disparity between the shoulder widths shown above and the paved shoulders on the roadway plans, this should be addressed as early in the process as possible since these should generally match.

2.9.1.4 Design Exceptions

When a project is implemented using Federal Funds and the structural capacity and/or width characteristics do not meet the above criteria, a design request exception will be submitted to the Chief Engineer for approval, unless the Restoration Procedure and Standards (May 7, 1986) apply (See the 3R Guidelines).

The shoulder widths are based on AASHTO clear zone requirements and exceptions to the widths are almost non-existent. Using less width would require a design exception. In certain staging situations it might be cheaper to build the bridge wider in order to make one of the intermediate stages work as opposed to building a temporary structure to hold the traffic. Also there are times when a bridge replacement is programmed ahead of a project to parallel the existing bridge. In such a case it might make sense to provide the 38’ wide bridge that would be used by a 4-lane divided highway even though two-way traffic will be using it for a few years. But a design exception would still be required.

Also please note that the clear zones requirements on the superelevation standard can control the bridge width on roads with sharp curves and low traffic.

2.9.2 Bridge Lengths

The bridge length is mostly determined by the obstacle that the bridge must span. For nearly all road projects the obstacle falls within two general categories – Bodies of Water (Stream Crossings) or Travelways (Grade Separations).

2.9.2.1 Stream Crossings

The guidelines for setting the span lengths for Stream Crossings are outlined in the GDOT Drainage Manual.

2.9.2.2 Grade Separations

Bridge spans over roads or railroads shall be set in accordance with section 2.3 and shall be long enough to span the travelway, drainage ditches, shoulders, sidewalks, clear zone for the travelway, and the offset distance from the toe of slope paving or face of abutment wall.

2.9.3 Guidelines for selecting types of Superstructure

Economy in construction and maintenance is central to the choice of the type of superstructure. On larger more complex projects it is appropriate to perform a **Bridge Type Study** (Section 2.9.4). However on everyday projects that level of detail will not be necessary and the following guidelines can be used.

Square foot costs (out-to-out width):
Short spans on pile bents: $80
PSC beams on concrete bents: $95
Steel beams on concrete bents: $140

Historically, some of the most economical types of bridge that the DOT builds consist of reinforced concreted deck girders (“RCDGs” or “T-beams”) on pile bents. By default, then, when economy is only defining selection criteria, this is the type of bridge you should consider first at every appropriate location. These spans are typically either 30 feet long (depth 2’-3”) or 40 feet (depth 2’-9”) long with the preference being for 40-foot spans (maximum). When running Hydraulics to determine the minimum bridge length it would be acceptable to just try 40-foot spans. If a 120’ bridge did not work, the next increment would be 160’ even if a 130’ bridge might work. The 160’ bridge would still be the minimum length bridge that works.

Due to the number of t-beam spans that are being redesigned by the contractors to Type I Mod PSC, designers may now opt to utilize Type I Mod bridges by default subject to meeting the minimum bottom of beam. Also t-beams may still be more economical than Type I Mods on low-lying bridges where the cost of falsework will be less.

In some cases it may be just as inexpensive to use longer spans on pile bents. Since a Type II uses roughly the same amount of concrete as a Type I Mod it makes sense that the superstructure cost for a 50-foot Type II would be the same per foot as a Type I Mod. For preliminary layouts the maximum span length on pile bents is 50 feet. Spans up to 70 feet have been used on pile bents using PSC piles (up to 24 inches square). However it is impossible to know if the final BFI will recommend PSC piles, even in south Georgia. Therefore to avoid a late redesign to revert to 50-foot spans when H-piles are eventually recommended, just use 50 feet as the maximum span length on preliminary layouts. If you have a BFI in hand recommending PSC piles, you could utilize longer spans. Because longer spans require heavier piling and pile hammers, spans longer than 50 feet may not be economical on small bridges.

Pile bents obviously do not work everywhere. Longer spans with concrete bents will be required to span a stream (if there are endangered species, scour problems or debris build-up problems) or roadway. If rock or hard layers are close to the surface pile bents will not be an option and would affect the layout of the spans. Although a BFI might recommend spread footings, pilot holes or drilled shafts at pile bents, the cost of these items would make longer spans cheaper since they would require fewer pilot holes or shafts. Note that pilot holes have fallen out of favor with OMR due to high costs compared to drilled shafts. Also if the bridge height exceeds twenty feet a pile bent might not design and concrete bents would be necessary.

A bridge could consist of a longer span (or spans) over a river with a series of T-beam spans on the over banks. However if you had only two T-beam spans it might be cheaper to just span from the concrete bent at the long span all the way to the end bent with an 80-foot span. Even if you had three T-beam spans, if the long span was 120’ already it might not be bad to go ahead and span the last 120’ to the end of the bridge.

When long spans are required the least expensive type of construction consists of a prestressed beam. Economical spans of up to 140’ can be achieved though 120’ to 130’ will give a more economical beam spacing and easier-to-achieve concrete strengths and strand patterns. Use the design charts in section 3.12 to select the type of beam needed for a given length. GDOT prefers that very little consideration be given to using the same beam type for two different span lengths. For instance if you had two 120’ spans and then a 140’ span, the preference would be for the 120’s to be 63” Bulb Tees and the 140’ span to be a 72” Bulb Tee unless it was in a visible area where the difference in beam depths would be noticed by the public. Such visible areas would be for grade separations or stream crossings with significant adjacent development. For more details, see section 3.12.2.6.

Occasionally it is required to bridge over the stream and the hydraulic opening requirements lead to side spans of less than 30 feet. In this case a one-span bridge may be best. However it is difficult to set long beams across a stream so justification needs to be provided in the hydraulic study stating how the beams will be set (it may be possible to set them from the detour bridge or the adjacent bridge with temporary traffic control).

Beams are very expensive components of a superstructure so it is usually worthwhile to try and max out the spacing to 9' and eliminate beams. If it took six 72" Bulb Tees to do what seven 63" Bulb Tees would do, it might be worthwhile (though a similar comparison using 2002 pay item prices indicated it was better to use more 63's). Any spacing greater than 9 feet needs prior approval of Bridge Design (10'-6" is the max that will be approved). This is really something best left to the final design of the bridge and is discussed in greater detail in the PSC beam design section.

Steel beam bridges are typically more expensive than PSC beams. Typically, then, steel bridges are avoided with some exceptions. If the required span length exceeds 150' then steel should be considered (though a Bridge Type Study would probably be appropriate). Also on some urban bridges a shallow superstructure may be required and steel may be the only way to achieve that. Finally, for bridge widening, it is the practice to match the superstructure type so steel would be used if the bridge to be widened was already steel.

Another less-used option for long-spans is steel or concrete box girder construction. Generally the DOT no longer uses concrete box girders due to the extensive falsework required. However cast in place box girders or segmental box construction should be considered in the Bridge Type Study for appropriate situations.

When the width of the bridge is constant, every effort should be made to make the beams parallel within each span. On curved bridges, the beams will normally be parallel to the chord of the centerline from BFPR or centerline bent to centerline bent. Also, the centerlines of exterior beams should meet at the centerlines of the intermediate bents. On wide curved bridges it can be effective to put the exterior beams on chords and then make beams on each side parallel to the exterior beam, leaving only one oddball bay along the center of the bridge. Placing all beams on their own chords will typically mean none are parallel and make for complicated deck formwork.

On bridges with very sharp skews it may be appropriate to use transverse girders rather than longitudinal beams as would be used conventionally. This type of bridge has different names including "scissors" or "braided ramp" bridge. It results in many shorter beams that only partially support the roadway and therefore is sometimes also called an outrigger bridge. There is no definitive policy on whether to include a deck on the portion outside the roadway limits or leave the beams with an uncovered top flange. Again, a Bridge Type Study may be appropriate to compare the cost of so many shorter transverse beams with the cost of a few long beams running longitudinally.

Wall abutments may be cheaper than spanning a 2:1 end slope on grade separations (especially wide bridges) and this should also be part of the investigation of the most economical type of bridge.

2.9.4 Bridge Type Study

A Bridge Type Study should be performed whenever the Estimated Construction cost of a single bridge is expected to exceed $5M.

This report shall serve as the backup data supporting the structure type chosen for a project.

2.9.4.1 Purpose

The Bridge Type Study when required will establish what alternative(s) will be carried forward in the Preliminary and Construction Document phases. When alternate designs are considered, equality between the alternates is essential in ensuring equitable competition and optimum cost effectiveness. This equality includes achieving uniformity of design criteria, material requirements and development of unit costs.

2.9.4.2 Format

The report shall use 8 ½” by 11” pages with drawings on larger sheets, if necessary, but folded to fit the report. The report shall be neatly written and the contents presented in a logical sequence with narrative, as required, to explain the section contents. An Executive Summary shall compare the relative features and costs of the alternates considered and recommend alternate(s) to be carried forward into the Preliminary Phase.

The Bridge Type Study should be as self-contained as possible by including all arguments that establish, justify, support, or prove the conclusions. It is acceptable to make reference to other documents that will be included in the final submittal package: however, any documentation that will help emphasize a point, support a statement or clarify a conclusion should be used. Such documentation may include drawings, clear and concise views, or other such illustrated information that can assist in presenting design intent and solutions.

2.9.4.3 Contents

Information other than cost, affecting the selection of an alternate, shall also be included. This requires consideration of geotechnical survey data (if available), life cycle maintenance costs, construction time and staging assumptions, constructability, maintenance of traffic, aesthetics, etc. Various methods of handling traffic during construction should be thoroughly investigated. Data provided by others should be thoroughly reviewed and if deemed insufficient or in error should be brought to the attention of the provider. The major items considered shall be:

2.9.4.3.1 Bridge Layout

Span Arrangement, Proportion, and Bridge Length: Column and/or pier locations are subject to vertical and horizontal clearance requirements. After these considerations are met, span lengths are governed by economics and aesthetic considerations.

Piers located in a divided highway median must be protected from traffic when located within the clear zone. Generally this will be accomplished by guardrail or concrete barrier.

Superstructure depths (grade separation structures in particular) shall be kept to the minimum consistent with good engineering practice. Recommended depth/span ratios are shown in the AASHTO Bridge specifications.

Statical System: The economic and engineering advantage of simple span vs. continuous spans should be addressed.

Superstructure: Consider prestressed concrete girders, steel rolled sections, steel plate girders, steel or concrete box girders, and other DEPARTMENT approved sections.

Combinations: The above in combination with various foundation types, such as piles, drilled shafts and/or spread footings. For piles and drilled shafts, assume size, length, and capacities from geotechnical information (if available). For spread footings, allowable bearing pressure should also be assumed from geotechnical information (if available).

2.9.4.3.2 Costs

Quantity Estimates: For minor bridges rough quantities (such as reinforcing steel based on lbs./cu.ft. of concrete) may be sufficient. However, for major and complex bridges the degree of accuracy may require more exact calculations keeping in mind that the intent is to establish relative costs between alternates and not necessarily to the accuracy required for a final estimate. Also, for major and complex structures it may be necessary to develop unit costs from an analysis of fabrication, storage, delivery and erection costs.

Unit Costs: Data available from the DEPARTMENT or contractors and suppliers should be used to arrive at unit costs. The sources of all price data should be recorded for later reference.

Cost Curves: For each alternate establish the most economical span arrangement, i.e., minimum combined superstructure and substructure cost.

2.9.4.3.3 Aesthetics

Any bridge design must integrate three basic elements: efficiency, economy and elegance. Regardless of size and location, the quality of the structure and its aesthetic attributes should be carefully considered by the Designer.

A successful bridge design will then be elegant or aesthetically pleasing in and of itself and compatible with the site by proper attention to form, shapes and proportions. Attention to details is of primary importance in achieving a continuity of form and lines.

The Designer must consider the totality of the structure as well as its individual components. A disregard for this continuity or lack of attention to detail can spoil the best intent. In bridge aesthetics, the designer is dealing with the basic structure itself; not with enhancement, additions, or other superficial touches.

The challenge differs for a major and a minor structure. Indeed, the challenge may be greater the smaller the bridge. Major structures, because of their longer spans, taller piers, or curving geometry offer opportunities not available for minor bridges.

Multi-bridge projects, such as interchanges, is an area where aesthetics play an important role because of their high visibility to a large number of motorists. In this instance, a conformity of theme and unifying appearance should be created. Avoid abrupt changes in structural features.

The level of aesthetic effort shall include an emphasis on full integration of efficiency, economy, and elegance in all bridge components and the structure as a whole. Consideration should be given to structural systems that are inherently more pleasing, such as hammerhead or "T" shaped piers, oval or polygonal shaped columns, piers in lieu of bents, smooth transitions at superstructure depth change locations, etc. Additional emphasis should be placed on the surroundings at interchanges where landscaping or unique features need to be considered.

2.9.4.3.4 Constructability and Maintainability

Each viable structure concept should be evaluated for constructibility. Items such as member sizes, handling, fabricating, and transporting members, maintenance of traffic, construction staging, equipment requirements, etc. should be considered. Special evaluation shall be made to insure against potential problems that may occur in obtaining permits and equipment to transport long and/or heavy members form point of manufacture to the project site. Also, considerations for future maintenance inspection shall be taken into account in the structure's design. Such considerations may include the need for 6 feet minimum headroom inside steel or concrete box girder superstructures. The intent of this requirement is to assure that all special construction and maintenance requirements are identified and appropriately reflected in the consideration of any concept that is to be recommended for design.

2.9.4.3.5 Conclusion

Following submittal of the Bridge Type Study, the DEPARTMENT should have enough data to select either one or more alternates for development in the next phase of design.

3 Superstructure

3.1 Deck Design

3.1.1 Design Method

The deck is designed using service load design in order to provide a stiffer deck that is less subject to cracking. Slabs shall be designed so that the main slab reinforcement is the same in the bottom of the slab as in the top. To achieve this, the effective depth shall be taken as the distance from the bottom of the slab to the centroid of the top main reinforcing steel for both positive and negative moment. Positive and negative moments shall be assumed to be equal and shall be calculated in accordance with the AASHTO Specifications.

For simplicity and consistency, use the GDOT slab charts (at the end of this section; output is from BRSLAB07). When using the slab charts, be aware that the effective slab is taken at the face of the beam for T-beams, at the face of top flange for AASHTO Types I-IV and the quarter point of the top flange for steel beams and wide flange PSC beams such as the Type V and Bulb Tees. Also be aware that the slab charts use a continuity factor that assumes the slab is continuous over 3 or more supports.

Problems have been encountered during deck rehabilitation work where slabs were thinner than 7 inches. Therefore the slab design program has been modified to use at least a 7-inch slab. These changes are reflected in BRSLAB07, however the old version BRSLAB03 is still available if a thin slab is needed. The maximum spacing of transverse #5 bars is 9 inches.

It is desirable to design the overhang using service loads as well, however it is acceptable to use load factor for the design of the overhangs. This is not really in conflict with the design of decks because overhang loadings are not occurring on a day-to-day basis whereas the slab between beams is subject to many, many cycles of load. Keep the overhang to around half of the beam spacing but avoid exceeding 4'. For large overhangs, you may find that these requirements will not allow a design solution for either design method, so it is prudent to try to limit overhang width to 50% of the beam spacing with an absolute maximum width of 4'- 7 ½". Never make the overhang slab depth less than the rest of the deck. Also a rule of thumb is to keep the overhang no more than one inch thicker than the rest of the slab. On curved bridges provide a sufficient overhang to incorporate the drip bead (3.5 inches).

3.1.2 Materials

Use Grade 60 reinforcement with an allowable stress of 24,000 psi. Use Class AA concrete that has a design strength of 3500 psi and an allowable stress of 1400 psi.

3.1.3 Loads

Use a future paving allowance of 30 psf on all bridges. Generally a form weight of 16 pounds per square foot is used to account for the weight of metal forms and the concrete in the corrugations and form sag. The designer shall *not* show any reference on the Bridge Plans for additional design weight due to metal stay-in-place deck forms. The deck can be redesigned thinner if rebar is spaced to fall into the corrugations, but this is not done and contractors never submit redesigns to use this scheme either. The wheel load is 16 kips for HS-20.

3.1.4 Detailing

The top clearance varies from 2 ¼" on major routes south of the Fall Line (see Figure 4-4) to 2 ¾" on major routes in north Georgia. Clearance on minor routes (county roads with ADT less than 2000) is reduced by ¼".

In bridges with simple spans and decks continuous at the intermediate bents, only the #6 bars in the top of the deck should be continuous through the required construction joint at the bent. The length of these bars should be 10’-0” total, 5’-0” on each side of the bent. Two #6 bars should be placed between each pair of #4 bars in the top of the deck. The #4 bars should end 2” from the construction joint.

Reinforcement shall not exceed 60 feet in length. In a span that exceeds 60 feet make the lapping bars nearly equal length to avoid bars approaching 60 feet. Use a Class C lap for #4 and #5 bars in the deck even if laps are staggered in case bars are not installed with staggered laps.

Epoxy coated reinforcing steel shall be used in the top mat of the deck and in the traffic side of the barrier or parapet and endpost for bridges north of the fall line (Fig. 2.2.3) in the following locations:

1. Mainline interstate bridges
2. Post-tensioned concrete box girders
3. Interstate ramp bridges
4. Crossroads over the interstate where interchanges are present.

At these locations, superstructure bars on the traffic side of the bridge with less than 4” of cover should be epoxy coated. Epoxy coated bars are not required in sidewalks and medians.

Provide 5 - #5 bars in a fan arrangement in the top of the deck just below the top mat in acute corners when the enclosed angle is 75 degrees or less. The designer should ensure that these bars are shown in the corner and adjacent to the edge of the slab on the plans. They are typically 5 to 10 feet long. The bars are necessary at intermediate bents with simple spans; at the ends of continuous units, and at construction joints in continuous units. The same treatment should be given to acute corners adjacent to staged construction.

On bridges with sharp skews, the transverse reinforcement is placed normal to the centerline meaning it has to be clipped and bent near the bents. However on slight skews (85-90 degrees) the reinforcement can be placed parallel to the bents to avoid clipping. When detailing clipped reinforcement in skewed spans it is not necessary to detail the bends and the varying lengths of the clipped bars. Just include quantities as if the bars wouldn't be clipped.

PSC deck panels are no longer used and should not be accommodated in your design.

The cross-slope of the deck should match the roadway plans. Typically the cross-slope is 2% on a normal crown, but is sometimes shown as ¼ inch per foot.

3.1.5 Grooving

All bridges will be grooved per Section 500 of the specifications to within one foot of the barrier or curb face. Grooving is a pay item. Do not groove under sidewalks unless you know they are temporary. Do groove under removable medians.

3.1.6 Overlays

When it is necessary to overlay a cast-in-place concrete deck, use a portland cement concrete overlay. The minimum thickness should be 2" and this should be shown on the Plans. If the overlay covers only part of the deck and the remaining part of the deck is grooved, the overlay should be grooved. Coordination with the Project Manager will be necessary to ensure that the approach slab elevations match the bridge deck.

When a concrete overlay becomes very thick, the possibility of the overlay cracking due to temperature effects is increased. Therefore, when the thickness of an overlay is 6 inches ore greater, a mat of No. 4 bars at 18 inches each way shall be placed in the top of the overlay. Measure the thickness from the top of the existing deck reinforcing. The mat of steel in the overlay should have the same cover as if it were deck steel.

3.1.7 Ride Quality

The Specifications require the deck to meet certain profilograph requirements on 4 lane state routes and on 2 lane state routes with current traffic of 2000 vehicles per day or higher. The Bridge Office policy is to require the profilograph tests at all state route bridges and at any other bridge where the design year traffic is 2000 vpd or higher. On plans for routes which meet the Bridge Office criteria but that do not meet the Specification requirements for profilograph testing, add a general note requiring the testing to override the gap left by the Specifications.

SERVICE LOAD DESIGN OF BRIDGE SLAB
Minimum slab thickness is 7"
Maximum main reinforcement spacing is 9"

Georgia Department of Transportation 19-OCT-07
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WHEEL LOAD (Kips)	fc (ksi)	fs (ksi)	n	SLAB COVER (in)	FUTURE PAVING (kips/ft^2)	CONTINUITY FACTOR
16.00	1.400	24.000	9	2.000	0.030	0.8

EFFECTIVE SPAN LENGTH (ft-in)	SLAB THICKNESS MINIMUM (in)	SLAB THICKNESS ACTUAL (in)	SIZE AND SPACING OF MAIN REINFORCEMENT (in)	DISTRIBUTION REINFORCEMENT MIDDLE HALF	DISTRIBUTION REINFORCEMENT OUTER QUARTERS
3- 6	6.0650	7.000	# 5 at 9.000	3-# 4	2-# 4
3- 7	6.0963	7.000	# 5 at 9.000	3-# 4	2-# 4
3- 8	6.1274	7.000	# 5 at 9.000	3-# 4	2-# 4
3- 9	6.1583	7.000	# 5 at 9.000	3-# 4	2-# 4
3-10	6.1891	7.000	# 5 at 9.000	3-# 4	2-# 4
3-11	6.2198	7.000	# 5 at 9.000	3-# 4	2-# 4
4- 0	6.2503	7.000	# 5 at 9.000	3-# 4	2-# 4
4- 1	6.2807	7.000	# 5 at 9.000	3-# 4	2-# 4
4- 2	6.3110	7.000	# 5 at 9.000	3-# 4	2-# 4
4- 3	6.3411	7.000	# 5 at 8.875	3-# 4	2-# 4
4- 4	6.3711	7.000	# 5 at 8.750	4-# 4	2-# 4
4- 5	6.4009	7.000	# 5 at 8.625	4-# 4	2-# 4
4- 6	6.4307	7.000	# 5 at 8.500	4-# 4	2-# 4
4- 7	6.4603	7.000	# 5 at 8.375	4-# 4	2-# 4
4- 8	6.4898	7.000	# 5 at 8.250	4-# 4	2-# 4
4- 9	6.5192	7.000	# 5 at 8.125	4-# 4	2-# 4
4-10	6.5484	7.000	# 5 at 8.000	4-# 4	2-# 4
4-11	6.5776	7.000	# 5 at 7.875	4-# 4	2-# 4
5- 0	6.6067	7.000	# 5 at 7.750	4-# 4	2-# 4
5- 1	6.6356	7.000	# 5 at 7.625	5-# 4	4-# 4
5- 2	6.6644	7.000	# 5 at 7.625	5-# 4	4-# 4
5- 3	6.6932	7.000	# 5 at 7.500	5-# 4	4-# 4
5- 4	6.7218	7.000	# 5 at 7.375	5-# 4	4-# 4
5- 5	6.7503	7.000	# 5 at 7.250	5-# 4	4-# 4
5- 6	6.7788	7.000	# 5 at 7.250	5-# 4	4-# 4
5- 7	6.8071	7.000	# 5 at 7.125	5-# 4	4-# 4
5- 8	6.8354	7.000	# 5 at 7.000	5-# 4	4-# 4
5- 9	6.8635	7.000	# 5 at 6.875	6-# 4	4-# 4
5-10	6.8916	7.000	# 5 at 6.875	6-# 4	4-# 4
5-11	6.9196	7.000	# 5 at 6.750	6-# 4	4-# 4
6- 0	6.9475	7.000	# 5 at 6.625	6-# 4	4-# 4
6- 1	6.9753	7.000	# 5 at 6.625	6-# 4	4-# 4
6- 2	7.0060	7.125	# 5 at 6.625	6-# 4	4-# 4
6- 3	7.0337	7.125	# 5 at 6.625	6-# 4	4-# 4
6- 4	7.0613	7.125	# 5 at 6.500	6-# 4	4-# 4
6- 5	7.0889	7.125	# 5 at 6.500	7-# 4	4-# 4

SERVICE LOAD DESIGN OF BRIDGE SLAB
Minimum slab thickness is 7"
Maximum main reinforcement spacing is 9"

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WHEEL LOAD (Kips)	fc (ksi)	fs (ksi)	n	SLAB COVER (in)	FUTURE PAVING (kips/ft^2)	CONTINUITY FACTOR
16.00	1.400	24.000	9	2.000	0.030	0.8

EFFECTIVE SPAN LENGTH (ft-in)	SLAB THICKNESS MINIMUM (in)	SLAB THICKNESS ACTUAL (in)	SIZE AND SPACING OF MAIN REINFORCEMENT (in)	DISTRIBUTION REINFORCEMENT MIDDLE HALF	DISTRIBUTION REINFORCEMENT OUTER QUARTERS
6- 6	7.1164	7.125	# 5 at 6.375	7-# 4	4-# 4
6- 7	7.1470	7.250	# 5 at 6.500	7-# 4	4-# 4
6- 8	7.1744	7.250	# 5 at 6.375	7-# 4	4-# 4
6- 9	7.2018	7.250	# 5 at 6.375	7-# 4	4-# 4
6-10	7.2290	7.250	# 5 at 6.250	7-# 4	4-# 4
6-11	7.2597	7.375	# 5 at 6.375	7-# 4	4-# 4
7- 0	7.2869	7.375	# 5 at 6.250	7-# 4	4-# 4
7- 1	7.3140	7.375	# 5 at 6.125	8-# 4	4-# 4
7- 2	7.3410	7.375	# 5 at 6.125	8-# 4	4-# 4
7- 3	7.3680	7.375	# 5 at 6.000	8-# 4	4-# 4
7- 4	7.3988	7.500	# 5 at 6.125	8-# 4	4-# 4
7- 5	7.4257	7.500	# 5 at 6.125	8-# 4	4-# 4
7- 6	7.4525	7.500	# 5 at 6.000	8-# 4	4-# 4
7- 7	7.4793	7.500	# 5 at 5.875	8-# 4	4-# 4
7- 8	7.5102	7.625	# 5 at 6.000	8-# 4	4-# 4
7- 9	7.5369	7.625	# 5 at 6.000	9-# 4	6-# 4
7-10	7.5636	7.625	# 5 at 5.875	9-# 4	6-# 4
7-11	7.5902	7.625	# 5 at 5.875	9-# 4	6-# 4
8- 0	7.6167	7.625	# 5 at 5.750	9-# 4	6-# 4
8- 1	7.6477	7.750	# 5 at 5.875	9-# 4	6-# 4
8- 2	7.6742	7.750	# 5 at 5.750	9-# 4	6-# 4
8- 3	7.7007	7.750	# 5 at 5.750	9-# 4	6-# 4
8- 4	7.7271	7.750	# 5 at 5.625	10-# 4	6-# 4
8- 5	7.7582	7.875	# 5 at 5.750	10-# 4	6-# 4
8- 6	7.7846	7.875	# 5 at 5.625	10-# 4	6-# 4
8- 7	7.8109	7.875	# 5 at 5.625	10-# 4	6-# 4
8- 8	7.8372	7.875	# 5 at 5.625	10-# 4	6-# 4
8- 9	7.8635	7.875	# 5 at 5.500	10-# 4	6-# 4
8-10	7.8948	8.000	# 5 at 5.625	10-# 4	6-# 4
8-11	7.9210	8.000	# 5 at 5.500	10-# 4	6-# 4
9- 0	7.9471	8.000	# 5 at 5.500	11-# 4	6-# 4
9- 1	7.9732	8.000	# 5 at 5.375	11-# 4	6-# 4
9- 2	7.9993	8.000	# 5 at 5.375	11-# 4	6-# 4
9- 3	8.0308	8.125	# 5 at 5.375	11-# 4	6-# 4
9- 4	8.0569	8.125	# 5 at 5.375	11-# 4	6-# 4
9- 5	8.0829	8.125	# 5 at 5.375	11-# 4	6-# 4

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SERVICE LOAD DESIGN OF BRIDGE SLAB
Minimum slab thickness is 7"
Maximum main reinforcement spacing is 9"

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WHEEL LOAD (Kips)	fc (ksi)	fs (ksi)	n	SLAB COVER (in)	FUTURE PAVING (kips/ft^2)	CONTINUITY FACTOR
16.00	1.400	24.000	9	2.000	0.030	0.8

EFFECTIVE SPAN LENGTH (ft-in)	SLAB THICKNESS MINIMUM (in)	SLAB THICKNESS ACTUAL (in)	SIZE AND SPACING OF MAIN REINFORCEMENT (in)	DISTRIBUTION REINFORCEMENT MIDDLE HALF	DISTRIBUTION REINFORCEMENT OUTER QUARTERS
9- 6	8.1088	8.125	# 5 at 5.250	12-# 4	6-# 4
9- 7	8.1405	8.250	# 5 at 5.375	12-# 4	6-# 4
9- 8	8.1665	8.250	# 5 at 5.250	12-# 4	6-# 4
9- 9	8.1924	8.250	# 5 at 5.250	12-# 4	6-# 4
9-10	8.2183	8.250	# 5 at 5.250	12-# 4	6-# 4
9-11	8.2441	8.250	# 5 at 5.125	12-# 4	6-# 4
10- 0	8.2761	8.375	# 5 at 5.250	12-# 4	6-# 4
10- 1	8.3019	8.375	# 5 at 5.125	13-# 4	8-# 4
10- 2	8.3277	8.375	# 5 at 5.125	13-# 4	8-# 4
10- 3	8.3535	8.375	# 5 at 5.125	13-# 4	8-# 4
10- 4	8.3856	8.500	# 5 at 5.125	13-# 4	8-# 4
10- 5	8.4114	8.500	# 5 at 5.125	13-# 4	8-# 4
10- 6	8.4371	8.500	# 5 at 5.000	13-# 4	8-# 4
10- 7	8.4628	8.500	# 5 at 5.000	14-# 4	8-# 4
10- 8	8.4884	8.500	# 5 at 5.000	14-# 4	8-# 4
10- 9	8.5209	8.625	# 5 at 5.000	14-# 4	8-# 4
10-10	8.5466	8.625	# 5 at 5.000	14-# 4	8-# 4
10-11	8.6416	8.750	# 6 at 7.000	9-# 5	6-# 5
11- 0	8.6673	8.750	# 6 at 7.000	9-# 5	6-# 5
11- 1	8.6930	8.750	# 6 at 6.875	9-# 5	6-# 5
11- 2	8.7186	8.750	# 6 at 6.875	10-# 5	6-# 5
11- 3	8.7442	8.750	# 6 at 6.875	10-# 5	6-# 5
11- 4	8.7771	8.875	# 6 at 6.875	10-# 5	6-# 5
11- 5	8.8026	8.875	# 6 at 6.875	10-# 5	6-# 5
11- 6	8.8282	8.875	# 6 at 6.750	10-# 5	6-# 5
11- 7	8.8537	8.875	# 6 at 6.750	10-# 5	6-# 5
11- 8	8.8869	9.000	# 6 at 6.750	10-# 5	6-# 5
11- 9	8.9125	9.000	# 6 at 6.750	10-# 5	6-# 5
11-10	8.9380	9.000	# 6 at 6.625	10-# 5	6-# 5
11-11	8.9635	9.000	# 6 at 6.625	10-# 5	6-# 5
12- 0	8.9890	9.000	# 6 at 6.625	10-# 5	6-# 5

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SERVICE LOAD DESIGN OF BRIDGE SLAB
Minimum slab thickness is 7"
Maximum main reinforcement spacing is 9"

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WHEEL LOAD (Kips)	fc (ksi)	fs (ksi)	n	SLAB COVER (in)	FUTURE PAVING (kips/ft^2)	CONTINUITY FACTOR
16.00	1.400	24.000	9	2.250	0.030	0.8

EFFECTIVE SPAN LENGTH (ft-in)	SLAB THICKNESS MINIMUM (in)	SLAB THICKNESS ACTUAL (in)	SIZE AND SPACING OF MAIN REINFORCEMENT (in)	DISTRIBUTION REINFORCEMENT MIDDLE HALF	DISTRIBUTION REINFORCEMENT OUTER QUARTERS
3- 6	6.3150	7.000	# 5 at 9.000	3-# 4	2-# 4
3- 7	6.3463	7.000	# 5 at 9.000	3-# 4	2-# 4
3- 8	6.3774	7.000	# 5 at 9.000	3-# 4	2-# 4
3- 9	6.4083	7.000	# 5 at 9.000	3-# 4	2-# 4
3-10	6.4391	7.000	# 5 at 9.000	3-# 4	2-# 4
3-11	6.4698	7.000	# 5 at 8.875	3-# 4	2-# 4
4- 0	6.5003	7.000	# 5 at 8.750	3-# 4	2-# 4
4- 1	6.5307	7.000	# 5 at 8.625	3-# 4	2-# 4
4- 2	6.5610	7.000	# 5 at 8.500	4-# 4	2-# 4
4- 3	6.5911	7.000	# 5 at 8.375	4-# 4	2-# 4
4- 4	6.6211	7.000	# 5 at 8.250	4-# 4	2-# 4
4- 5	6.6509	7.000	# 5 at 8.125	4-# 4	2-# 4
4- 6	6.6807	7.000	# 5 at 8.000	4-# 4	2-# 4
4- 7	6.7103	7.000	# 5 at 7.875	4-# 4	2-# 4
4- 8	6.7398	7.000	# 5 at 7.750	4-# 4	2-# 4
4- 9	6.7692	7.000	# 5 at 7.625	4-# 4	2-# 4
4-10	6.7984	7.000	# 5 at 7.625	4-# 4	2-# 4
4-11	6.8276	7.000	# 5 at 7.500	5-# 4	4-# 4
5- 0	6.8567	7.000	# 5 at 7.375	5-# 4	4-# 4
5- 1	6.8856	7.000	# 5 at 7.250	5-# 4	4-# 4
5- 2	6.9144	7.000	# 5 at 7.125	5-# 4	4-# 4
5- 3	6.9432	7.000	# 5 at 7.125	5-# 4	4-# 4
5- 4	6.9718	7.000	# 5 at 7.000	5-# 4	4-# 4
5- 5	7.0028	7.125	# 5 at 7.125	5-# 4	4-# 4
5- 6	7.0313	7.125	# 5 at 7.000	5-# 4	4-# 4
5- 7	7.0597	7.125	# 5 at 6.875	5-# 4	4-# 4
5- 8	7.0880	7.125	# 5 at 6.875	6-# 4	4-# 4
5- 9	7.1162	7.125	# 5 at 6.750	6-# 4	4-# 4
5-10	7.1471	7.250	# 5 at 6.875	6-# 4	4-# 4
5-11	7.1752	7.250	# 5 at 6.750	6-# 4	4-# 4
6- 0	7.2032	7.250	# 5 at 6.625	6-# 4	4-# 4
6- 1	7.2311	7.250	# 5 at 6.625	6-# 4	4-# 4
6- 2	7.2619	7.375	# 5 at 6.625	6-# 4	4-# 4
6- 3	7.2898	7.375	# 5 at 6.625	6-# 4	4-# 4
6- 4	7.3175	7.375	# 5 at 6.500	6-# 4	4-# 4
6- 5	7.3452	7.375	# 5 at 6.375	7-# 4	4-# 4

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SERVICE LOAD DESIGN OF BRIDGE SLAB
Minimum slab thickness is 7"
Maximum main reinforcement spacing is 9"

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WHEEL LOAD (Kips)	fc (ksi)	fs (ksi)	n	SLAB COVER (in)	FUTURE PAVING (kips/ft^2)	CONTINUITY FACTOR
16.00	1.400	24.000	9	2.250	0.030	0.8

EFFECTIVE SPAN LENGTH (ft-in)	SLAB THICKNESS MINIMUM (in)	SLAB THICKNESS ACTUAL (in)	SIZE AND SPACING OF MAIN REINFORCEMENT (in)	DISTRIBUTION REINFORCEMENT MIDDLE HALF	DISTRIBUTION REINFORCEMENT OUTER QUARTERS
6- 6	7.3728	7.375	# 5 at 6.375	7-# 4	4-# 4
6- 7	7.4036	7.500	# 5 at 6.500	7-# 4	4-# 4
6- 8	7.4311	7.500	# 5 at 6.375	7-# 4	4-# 4
6- 9	7.4586	7.500	# 5 at 6.250	7-# 4	4-# 4
6-10	7.4859	7.500	# 5 at 6.250	7-# 4	4-# 4
6-11	7.5168	7.625	# 5 at 6.250	7-# 4	4-# 4
7- 0	7.5441	7.625	# 5 at 6.250	7-# 4	4-# 4
7- 1	7.5713	7.625	# 5 at 6.125	8-# 4	4-# 4
7- 2	7.5985	7.625	# 5 at 6.125	8-# 4	4-# 4
7- 3	7.6294	7.750	# 5 at 6.125	8-# 4	4-# 4
7- 4	7.6565	7.750	# 5 at 6.125	8-# 4	4-# 4
7- 5	7.6835	7.750	# 5 at 6.000	8-# 4	4-# 4
7- 6	7.7105	7.750	# 5 at 6.000	8-# 4	4-# 4
7- 7	7.7374	7.750	# 5 at 5.875	8-# 4	4-# 4
7- 8	7.7684	7.875	# 5 at 6.000	8-# 4	4-# 4
7- 9	7.7953	7.875	# 5 at 5.875	9-# 4	6-# 4
7-10	7.8221	7.875	# 5 at 5.875	9-# 4	6-# 4
7-11	7.8489	7.875	# 5 at 5.750	9-# 4	6-# 4
8- 0	7.8800	8.000	# 5 at 5.875	9-# 4	6-# 4
8- 1	7.9067	8.000	# 5 at 5.875	9-# 4	6-# 4
8- 2	7.9333	8.000	# 5 at 5.750	9-# 4	6-# 4
8- 3	7.9599	8.000	# 5 at 5.750	9-# 4	6-# 4
8- 4	7.9865	8.000	# 5 at 5.625	10-# 4	6-# 4
8- 5	8.0178	8.125	# 5 at 5.750	10-# 4	6-# 4
8- 6	8.0443	8.125	# 5 at 5.625	10-# 4	6-# 4
8- 7	8.0708	8.125	# 5 at 5.625	10-# 4	6-# 4
8- 8	8.0972	8.125	# 5 at 5.500	10-# 4	6-# 4
8- 9	8.1235	8.125	# 5 at 5.500	10-# 4	6-# 4
8-10	8.1550	8.250	# 5 at 5.500	10-# 4	6-# 4
8-11	8.1813	8.250	# 5 at 5.500	10-# 4	6-# 4
9- 0	8.2076	8.250	# 5 at 5.500	11-# 4	6-# 4
9- 1	8.2339	8.250	# 5 at 5.375	11-# 4	6-# 4
9- 2	8.2655	8.375	# 5 at 5.500	11-# 4	6-# 4
9- 3	8.2918	8.375	# 5 at 5.375	11-# 4	6-# 4
9- 4	8.3180	8.375	# 5 at 5.375	11-# 4	6-# 4
9- 5	8.3441	8.375	# 5 at 5.250	11-# 4	6-# 4

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SERVICE LOAD DESIGN OF BRIDGE SLAB
Minimum slab thickness is 7"
Maximum main reinforcement spacing is 9"

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WHEEL LOAD (Kips)	fc (ksi)	fs (ksi)	n	SLAB COVER (in)	FUTURE PAVING (kips/ft^2)	CONTINUITY FACTOR
16.00	1.400	24.000	9	2.250	0.030	0.8

EFFECTIVE SPAN LENGTH (ft-in)	SLAB THICKNESS MINIMUM (in)	SLAB THICKNESS ACTUAL (in)	SIZE AND SPACING OF MAIN REINFORCEMENT (in)	DISTRIBUTION REINFORCEMENT MIDDLE HALF	DISTRIBUTION REINFORCEMENT OUTER QUARTERS
9- 6	8.3702	8.375	# 5 at 5.250	12-# 4	6-# 4
9- 7	8.4021	8.500	# 5 at 5.375	12-# 4	6-# 4
9- 8	8.4282	8.500	# 5 at 5.250	12-# 4	6-# 4
9- 9	8.4542	8.500	# 5 at 5.250	12-# 4	6-# 4
9-10	8.4803	8.500	# 5 at 5.125	12-# 4	6-# 4
9-11	8.5123	8.625	# 5 at 5.250	12-# 4	6-# 4
10- 0	8.5383	8.625	# 5 at 5.125	12-# 4	6-# 4
10- 1	8.5643	8.625	# 5 at 5.125	13-# 4	8-# 4
10- 2	8.5903	8.625	# 5 at 5.125	13-# 4	8-# 4
10- 3	8.6162	8.625	# 5 at 5.000	13-# 4	8-# 4
10- 4	8.6485	8.750	# 5 at 5.125	13-# 4	8-# 4
10- 5	8.6744	8.750	# 5 at 5.000	13-# 4	8-# 4
10- 6	8.7003	8.750	# 5 at 5.000	13-# 4	8-# 4
10- 7	8.7261	8.750	# 5 at 5.000	14-# 4	8-# 4
10- 8	8.7587	8.875	# 5 at 5.000	14-# 4	8-# 4
10- 9	8.7845	8.875	# 5 at 5.000	14-# 4	8-# 4
10-10	8.8728	8.875	# 6 at 7.000	9-# 5	6-# 5
10-11	8.9056	9.000	# 6 at 7.000	9-# 5	6-# 5
11- 0	8.9314	9.000	# 6 at 7.000	9-# 5	6-# 5
11- 1	8.9572	9.000	# 6 at 6.875	9-# 5	6-# 5
11- 2	8.9830	9.000	# 6 at 6.875	10-# 5	6-# 5
11- 3	9.0159	9.125	# 6 at 6.875	10-# 5	6-# 5
11- 4	9.0417	9.125	# 6 at 6.875	10-# 5	6-# 5
11- 5	9.0675	9.125	# 6 at 6.750	10-# 5	6-# 5
11- 6	9.0932	9.125	# 6 at 6.750	10-# 5	6-# 5
11- 7	9.1189	9.125	# 6 at 6.750	10-# 5	6-# 5
11- 8	9.1522	9.250	# 6 at 6.750	10-# 5	6-# 5
11- 9	9.1779	9.250	# 6 at 6.750	10-# 5	6-# 5
11-10	9.2036	9.250	# 6 at 6.625	10-# 5	6-# 5
11-11	9.2293	9.250	# 6 at 6.625	10-# 5	6-# 5
12- 0	9.2628	9.375	# 6 at 6.625	10-# 5	6-# 5

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SERVICE LOAD DESIGN OF BRIDGE SLAB
Minimum slab thickness is 7"
Maximum main reinforcement spacing is 9"

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WHEEL LOAD (Kips)	fc (ksi)	fs (ksi)	n	SLAB COVER (in)	FUTURE PAVING (kips/ft^2)	CONTINUITY FACTOR
16.00	1.400	24.000	9	2.500	0.030	0.8

EFFECTIVE SPAN LENGTH (ft-in)	SLAB THICKNESS MINIMUM (in)	SLAB THICKNESS ACTUAL (in)	SIZE AND SPACING OF MAIN REINFORCEMENT (in)	DISTRIBUTION REINFORCEMENT MIDDLE HALF	DISTRIBUTION REINFORCEMENT OUTER QUARTERS
3- 6	6.5650	7.000	# 5 at 9.000	3-# 4	2-# 4
3- 7	6.5963	7.000	# 5 at 9.000	3-# 4	2-# 4
3- 8	6.6274	7.000	# 5 at 8.875	3-# 4	2-# 4
3- 9	6.6583	7.000	# 5 at 8.625	3-# 4	2-# 4
3-10	6.6891	7.000	# 5 at 8.500	3-# 4	2-# 4
3-11	6.7198	7.000	# 5 at 8.375	3-# 4	2-# 4
4- 0	6.7503	7.000	# 5 at 8.250	3-# 4	2-# 4
4- 1	6.7807	7.000	# 5 at 8.125	4-# 4	2-# 4
4- 2	6.8110	7.000	# 5 at 8.000	4-# 4	2-# 4
4- 3	6.8411	7.000	# 5 at 7.875	4-# 4	2-# 4
4- 4	6.8711	7.000	# 5 at 7.750	4-# 4	2-# 4
4- 5	6.9009	7.000	# 5 at 7.625	4-# 4	2-# 4
4- 6	6.9307	7.000	# 5 at 7.500	4-# 4	2-# 4
4- 7	6.9603	7.000	# 5 at 7.500	4-# 4	2-# 4
4- 8	6.9898	7.000	# 5 at 7.375	4-# 4	2-# 4
4- 9	7.0211	7.125	# 5 at 7.500	4-# 4	2-# 4
4-10	7.0505	7.125	# 5 at 7.375	5-# 4	4-# 4
4-11	7.0797	7.125	# 5 at 7.250	5-# 4	4-# 4
5- 0	7.1088	7.125	# 5 at 7.125	5-# 4	4-# 4
5- 1	7.1400	7.250	# 5 at 7.250	5-# 4	4-# 4
5- 2	7.1689	7.250	# 5 at 7.125	5-# 4	4-# 4
5- 3	7.1978	7.250	# 5 at 7.000	5-# 4	4-# 4
5- 4	7.2265	7.250	# 5 at 7.000	5-# 4	4-# 4
5- 5	7.2576	7.375	# 5 at 7.125	5-# 4	4-# 4
5- 6	7.2862	7.375	# 5 at 7.000	5-# 4	4-# 4
5- 7	7.3147	7.375	# 5 at 6.875	5-# 4	4-# 4
5- 8	7.3432	7.375	# 5 at 6.750	6-# 4	4-# 4
5- 9	7.3715	7.375	# 5 at 6.750	6-# 4	4-# 4
5-10	7.4025	7.500	# 5 at 6.750	6-# 4	4-# 4
5-11	7.4307	7.500	# 5 at 6.750	6-# 4	4-# 4
6- 0	7.4589	7.500	# 5 at 6.625	6-# 4	4-# 4
6- 1	7.4869	7.500	# 5 at 6.500	6-# 4	4-# 4
6- 2	7.5179	7.625	# 5 at 6.625	6-# 4	4-# 4
6- 3	7.5458	7.625	# 5 at 6.625	6-# 4	4-# 4
6- 4	7.5737	7.625	# 5 at 6.500	7-# 4	4-# 4
6- 5	7.6015	7.625	# 5 at 6.375	7-# 4	4-# 4

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SERVICE LOAD DESIGN OF BRIDGE SLAB
Minimum slab thickness is 7"
Maximum main reinforcement spacing is 9"

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WHEEL LOAD (Kips)	fc (ksi)	fs (ksi)	n	SLAB COVER (in)	FUTURE PAVING (kips/ft^2)	CONTINUITY FACTOR
16.00	1.400	24.000	9	2.500	0.030	0.8

EFFECTIVE SPAN LENGTH (ft-in)	SLAB THICKNESS MINIMUM (in)	SLAB THICKNESS ACTUAL (in)	SIZE AND SPACING OF MAIN REINFORCEMENT (in)	DISTRIBUTION REINFORCEMENT MIDDLE HALF	DISTRIBUTION REINFORCEMENT OUTER QUARTERS
6- 6	7.6324	7.750	# 5 at 6.500	7-# 4	4-# 4
6- 7	7.6602	7.750	# 5 at 6.375	7-# 4	4-# 4
6- 8	7.6878	7.750	# 5 at 6.375	7-# 4	4-# 4
6- 9	7.7154	7.750	# 5 at 6.250	7-# 4	4-# 4
6-10	7.7429	7.750	# 5 at 6.250	7-# 4	4-# 4
6-11	7.7739	7.875	# 5 at 6.250	7-# 4	4-# 4
7- 0	7.8013	7.875	# 5 at 6.250	7-# 4	4-# 4
7- 1	7.8286	7.875	# 5 at 6.125	8-# 4	4-# 4
7- 2	7.8559	7.875	# 5 at 6.125	8-# 4	4-# 4
7- 3	7.8870	8.000	# 5 at 6.125	8-# 4	4-# 4
7- 4	7.9142	8.000	# 5 at 6.125	8-# 4	4-# 4
7- 5	7.9414	8.000	# 5 at 6.000	8-# 4	4-# 4
7- 6	7.9685	8.000	# 5 at 6.000	8-# 4	4-# 4
7- 7	7.9956	8.000	# 5 at 5.875	8-# 4	4-# 4
7- 8	8.0267	8.125	# 5 at 6.000	8-# 4	4-# 4
7- 9	8.0537	8.125	# 5 at 5.875	9-# 4	6-# 4
7-10	8.0806	8.125	# 5 at 5.875	9-# 4	6-# 4
7-11	8.1075	8.125	# 5 at 5.750	9-# 4	6-# 4
8- 0	8.1388	8.250	# 5 at 5.875	9-# 4	6-# 4
8- 1	8.1656	8.250	# 5 at 5.750	9-# 4	6-# 4
8- 2	8.1924	8.250	# 5 at 5.750	9-# 4	6-# 4
8- 3	8.2192	8.250	# 5 at 5.625	9-# 4	6-# 4
8- 4	8.2459	8.250	# 5 at 5.625	10-# 4	6-# 4
8- 5	8.2773	8.375	# 5 at 5.750	10-# 4	6-# 4
8- 6	8.3039	8.375	# 5 at 5.625	10-# 4	6-# 4
8- 7	8.3305	8.375	# 5 at 5.625	10-# 4	6-# 4
8- 8	8.3571	8.375	# 5 at 5.500	10-# 4	6-# 4
8- 9	8.3887	8.500	# 5 at 5.625	10-# 4	6-# 4
8-10	8.4152	8.500	# 5 at 5.500	10-# 4	6-# 4
8-11	8.4417	8.500	# 5 at 5.500	11-# 4	6-# 4
9- 0	8.4681	8.500	# 5 at 5.375	11-# 4	6-# 4
9- 1	8.4945	8.500	# 5 at 5.375	11-# 4	6-# 4
9- 2	8.5263	8.625	# 5 at 5.375	11-# 4	6-# 4
9- 3	8.5527	8.625	# 5 at 5.375	11-# 4	6-# 4
9- 4	8.5790	8.625	# 5 at 5.375	11-# 4	6-# 4
9- 5	8.6053	8.625	# 5 at 5.250	11-# 4	6-# 4

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SERVICE LOAD DESIGN OF BRIDGE SLAB
Minimum slab thickness is 7"
Maximum main reinforcement spacing is 9"

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WHEEL LOAD (Kips)	fc (ksi)	fs (ksi)	n	SLAB COVER (in)	FUTURE PAVING (kips/ft^2)	CONTINUITY FACTOR
16.00	1.400	24.000	9	2.500	0.030	0.8

EFFECTIVE SPAN LENGTH (ft-in)	SLAB THICKNESS MINIMUM (in)	SLAB THICKNESS ACTUAL (in)	SIZE AND SPACING OF MAIN REINFORCEMENT (in)	DISTRIBUTION REINFORCEMENT MIDDLE HALF	DISTRIBUTION REINFORCEMENT OUTER QUARTERS
9- 6	8.6373	8.750	# 5 at 5.375	11-# 4	6-# 4
9- 7	8.6636	8.750	# 5 at 5.250	12-# 4	6-# 4
9- 8	8.6898	8.750	# 5 at 5.250	12-# 4	6-# 4
9- 9	8.7160	8.750	# 5 at 5.250	12-# 4	6-# 4
9-10	8.7422	8.750	# 5 at 5.125	12-# 4	6-# 4
9-11	8.7744	8.875	# 5 at 5.250	12-# 4	6-# 4
10- 0	8.8006	8.875	# 5 at 5.125	12-# 4	6-# 4
10- 1	8.8267	8.875	# 5 at 5.125	13-# 4	8-# 4
10- 2	8.8528	8.875	# 5 at 5.125	13-# 4	8-# 4
10- 3	8.8852	9.000	# 5 at 5.125	13-# 4	8-# 4
10- 4	8.9113	9.000	# 5 at 5.125	13-# 4	8-# 4
10- 5	8.9374	9.000	# 5 at 5.000	13-# 4	8-# 4
10- 6	8.9634	9.000	# 5 at 5.000	13-# 4	8-# 4
10- 7	8.9894	9.000	# 5 at 5.000	14-# 4	8-# 4
10- 8	9.0221	9.125	# 5 at 5.000	14-# 4	8-# 4
10- 9	9.0481	9.125	# 5 at 5.000	14-# 4	8-# 4
10-10	9.1434	9.250	# 6 at 7.000	9-# 5	6-# 5
10-11	9.1694	9.250	# 6 at 7.000	9-# 5	6-# 5
11- 0	9.1954	9.250	# 6 at 6.875	9-# 5	6-# 5
11- 1	9.2214	9.250	# 6 at 6.875	9-# 5	6-# 5
11- 2	9.2473	9.250	# 6 at 6.875	10-# 5	6-# 5
11- 3	9.2804	9.375	# 6 at 6.875	10-# 5	6-# 5
11- 4	9.3064	9.375	# 6 at 6.875	10-# 5	6-# 5
11- 5	9.3323	9.375	# 6 at 6.750	10-# 5	6-# 5
11- 6	9.3582	9.375	# 6 at 6.750	10-# 5	6-# 5
11- 7	9.3916	9.500	# 6 at 6.750	10-# 5	6-# 5
11- 8	9.4175	9.500	# 6 at 6.750	10-# 5	6-# 5
11- 9	9.4433	9.500	# 6 at 6.625	10-# 5	6-# 5
11-10	9.4692	9.500	# 6 at 6.625	10-# 5	6-# 5
11-11	9.4950	9.500	# 6 at 6.500	10-# 5	6-# 5
12- 0	9.5287	9.625	# 6 at 6.625	10-# 5	6-# 5

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SERVICE LOAD DESIGN OF BRIDGE SLAB
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16.00	1.400	24.000	9	2.750	0.030	0.8

EFFECTIVE SPAN LENGTH (ft-in)	SLAB THICKNESS MINIMUM (in)	SLAB THICKNESS ACTUAL (in)	SIZE AND SPACING OF MAIN REINFORCEMENT (in)	DISTRIBUTION REINFORCEMENT MIDDLE HALF	DISTRIBUTION REINFORCEMENT OUTER QUARTERS
3- 6	6.8150	7.000	# 5 at 8.625	3-# 4	2-# 4
3- 7	6.8463	7.000	# 5 at 8.375	3-# 4	2-# 4
3- 8	6.8774	7.000	# 5 at 8.250	3-# 4	2-# 4
3- 9	6.9083	7.000	# 5 at 8.125	3-# 4	2-# 4
3-10	6.9391	7.000	# 5 at 8.000	3-# 4	2-# 4
3-11	6.9698	7.000	# 5 at 7.875	4-# 4	2-# 4
4- 0	7.0018	7.125	# 5 at 8.000	4-# 4	2-# 4
4- 1	7.0323	7.125	# 5 at 7.875	4-# 4	2-# 4
4- 2	7.0626	7.125	# 5 at 7.750	4-# 4	2-# 4
4- 3	7.0927	7.125	# 5 at 7.625	4-# 4	2-# 4
4- 4	7.1228	7.125	# 5 at 7.500	4-# 4	2-# 4
4- 5	7.1544	7.250	# 5 at 7.625	4-# 4	2-# 4
4- 6	7.1843	7.250	# 5 at 7.500	4-# 4	2-# 4
4- 7	7.2140	7.250	# 5 at 7.500	4-# 4	2-# 4
4- 8	7.2436	7.250	# 5 at 7.375	4-# 4	2-# 4
4- 9	7.2751	7.375	# 5 at 7.500	4-# 4	2-# 4
4-10	7.3045	7.375	# 5 at 7.375	5-# 4	4-# 4
4-11	7.3338	7.375	# 5 at 7.250	5-# 4	4-# 4
5- 0	7.3630	7.375	# 5 at 7.125	5-# 4	4-# 4
5- 1	7.3943	7.500	# 5 at 7.250	5-# 4	4-# 4
5- 2	7.4234	7.500	# 5 at 7.125	5-# 4	4-# 4
5- 3	7.4524	7.500	# 5 at 7.000	5-# 4	4-# 4
5- 4	7.4812	7.500	# 5 at 7.000	5-# 4	4-# 4
5- 5	7.5124	7.625	# 5 at 7.000	5-# 4	4-# 4
5- 6	7.5412	7.625	# 5 at 7.000	5-# 4	4-# 4
5- 7	7.5698	7.625	# 5 at 6.875	6-# 4	4-# 4
5- 8	7.5984	7.625	# 5 at 6.750	6-# 4	4-# 4
5- 9	7.6295	7.750	# 5 at 6.875	6-# 4	4-# 4
5-10	7.6579	7.750	# 5 at 6.750	6-# 4	4-# 4
5-11	7.6863	7.750	# 5 at 6.750	6-# 4	4-# 4
6- 0	7.7145	7.750	# 5 at 6.625	6-# 4	4-# 4
6- 1	7.7427	7.750	# 5 at 6.500	6-# 4	4-# 4
6- 2	7.7738	7.875	# 5 at 6.625	6-# 4	4-# 4
6- 3	7.8019	7.875	# 5 at 6.500	6-# 4	4-# 4
6- 4	7.8299	7.875	# 5 at 6.500	7-# 4	4-# 4
6- 5	7.8578	7.875	# 5 at 6.375	7-# 4	4-# 4

SERVICE LOAD DESIGN OF BRIDGE SLAB
Minimum slab thickness is 7"
Maximum main reinforcement spacing is 9"

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16.00	1.400	24.000	9	2.750	0.030	0.8

EFFECTIVE SPAN LENGTH (ft-in)	SLAB THICKNESS MINIMUM (in)	SLAB THICKNESS ACTUAL (in)	SIZE AND SPACING OF MAIN REINFORCEMENT (in)	DISTRIBUTION REINFORCEMENT MIDDLE HALF	DISTRIBUTION REINFORCEMENT OUTER QUARTERS
6- 6	7.8889	8.000	# 5 at 6.500	7-# 4	4-# 4
6- 7	7.9167	8.000	# 5 at 6.375	7-# 4	4-# 4
6- 8	7.9445	8.000	# 5 at 6.375	7-# 4	4-# 4
6- 9	7.9722	8.000	# 5 at 6.250	7-# 4	4-# 4
6-10	7.9998	8.000	# 5 at 6.250	7-# 4	4-# 4
6-11	8.0309	8.125	# 5 at 6.250	7-# 4	4-# 4
7- 0	8.0585	8.125	# 5 at 6.250	7-# 4	4-# 4
7- 1	8.0860	8.125	# 5 at 6.125	8-# 4	4-# 4
7- 2	8.1134	8.125	# 5 at 6.125	8-# 4	4-# 4
7- 3	8.1446	8.250	# 5 at 6.125	8-# 4	4-# 4
7- 4	8.1719	8.250	# 5 at 6.125	8-# 4	4-# 4
7- 5	8.1992	8.250	# 5 at 6.000	8-# 4	4-# 4
7- 6	8.2265	8.250	# 5 at 6.000	8-# 4	4-# 4
7- 7	8.2577	8.375	# 5 at 6.000	8-# 4	4-# 4
7- 8	8.2849	8.375	# 5 at 6.000	8-# 4	4-# 4
7- 9	8.3121	8.375	# 5 at 5.875	9-# 4	6-# 4
7-10	8.3392	8.375	# 5 at 5.875	9-# 4	6-# 4
7-11	8.3662	8.375	# 5 at 5.750	9-# 4	6-# 4
8- 0	8.3976	8.500	# 5 at 5.875	9-# 4	6-# 4
8- 1	8.4246	8.500	# 5 at 5.750	9-# 4	6-# 4
8- 2	8.4515	8.500	# 5 at 5.750	9-# 4	6-# 4
8- 3	8.4784	8.500	# 5 at 5.625	9-# 4	6-# 4
8- 4	8.5099	8.625	# 5 at 5.750	9-# 4	6-# 4
8- 5	8.5367	8.625	# 5 at 5.625	10-# 4	6-# 4
8- 6	8.5636	8.625	# 5 at 5.625	10-# 4	6-# 4
8- 7	8.5903	8.625	# 5 at 5.500	10-# 4	6-# 4
8- 8	8.6170	8.625	# 5 at 5.500	10-# 4	6-# 4
8- 9	8.6487	8.750	# 5 at 5.625	10-# 4	6-# 4
8-10	8.6754	8.750	# 5 at 5.500	10-# 4	6-# 4
8-11	8.7020	8.750	# 5 at 5.500	11-# 4	6-# 4
9- 0	8.7286	8.750	# 5 at 5.375	11-# 4	6-# 4
9- 1	8.7605	8.875	# 5 at 5.500	11-# 4	6-# 4
9- 2	8.7871	8.875	# 5 at 5.375	11-# 4	6-# 4
9- 3	8.8136	8.875	# 5 at 5.375	11-# 4	6-# 4
9- 4	8.8401	8.875	# 5 at 5.375	11-# 4	6-# 4
9- 5	8.8665	8.875	# 5 at 5.250	12-# 4	6-# 4

SERVICE LOAD DESIGN OF BRIDGE SLAB
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16.00	1.400	24.000	9	2.750	0.030	0.8

EFFECTIVE SPAN LENGTH (ft-in)	SLAB THICKNESS MINIMUM (in)	SLAB THICKNESS ACTUAL (in)	SIZE AND SPACING OF MAIN REINFORCEMENT (in)	DISTRIBUTION REINFORCEMENT MIDDLE HALF	DISTRIBUTION REINFORCEMENT OUTER QUARTERS
9- 6	8.8986	9.000	# 5 at 5.375	11-# 4	6-# 4
9- 7	8.9251	9.000	# 5 at 5.250	12-# 4	6-# 4
9- 8	8.9515	9.000	# 5 at 5.250	12-# 4	6-# 4
9- 9	8.9778	9.000	# 5 at 5.125	12-# 4	6-# 4
9-10	9.0101	9.125	# 5 at 5.250	12-# 4	6-# 4
9-11	9.0365	9.125	# 5 at 5.125	12-# 4	6-# 4
10- 0	9.0628	9.125	# 5 at 5.125	12-# 4	6-# 4
10- 1	9.0891	9.125	# 5 at 5.125	13-# 4	8-# 4
10- 2	9.1153	9.125	# 5 at 5.000	13-# 4	8-# 4
10- 3	9.1479	9.250	# 5 at 5.125	13-# 4	8-# 4
10- 4	9.1741	9.250	# 5 at 5.000	13-# 4	8-# 4
10- 5	9.2003	9.250	# 5 at 5.000	13-# 4	8-# 4
10- 6	9.2265	9.250	# 5 at 5.000	14-# 4	8-# 4
10- 7	9.2593	9.375	# 5 at 5.000	13-# 4	8-# 4
10- 8	9.2855	9.375	# 5 at 5.000	14-# 4	8-# 4
10- 9	9.3742	9.375	# 6 at 7.000	9-# 5	6-# 5
10-10	9.4071	9.500	# 6 at 7.000	9-# 5	6-# 5
10-11	9.4333	9.500	# 6 at 7.000	9-# 5	6-# 5
11- 0	9.4594	9.500	# 6 at 6.875	9-# 5	6-# 5
11- 1	9.4855	9.500	# 6 at 6.875	10-# 5	6-# 5
11- 2	9.5188	9.625	# 6 at 6.875	9-# 5	6-# 5
11- 3	9.5449	9.625	# 6 at 6.875	10-# 5	6-# 5
11- 4	9.5710	9.625	# 6 at 6.750	10-# 5	6-# 5
11- 5	9.5971	9.625	# 6 at 6.750	10-# 5	6-# 5
11- 6	9.6231	9.625	# 6 at 6.625	10-# 5	6-# 5
11- 7	9.6566	9.750	# 6 at 6.750	10-# 5	6-# 5
11- 8	9.6827	9.750	# 6 at 6.750	10-# 5	6-# 5
11- 9	9.7087	9.750	# 6 at 6.625	10-# 5	6-# 5
11-10	9.7347	9.750	# 6 at 6.625	10-# 5	6-# 5
11-11	9.7685	9.875	# 6 at 6.625	10-# 5	6-# 5
12- 0	9.7945	9.875	# 6 at 6.625	10-# 5	6-# 5

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3.2 Construction Joints

3.2.1 Pour Strips

Pour strips are required for deck construction on widenings and in stage construction where the supporting members are:

a) Cast-in-place concrete deck girders (T-beams), because falsework is used to support the widening during construction; all falsework must be struck before pouring the pour strip.
b) Continuous steel beams. The exception is when the amount to be widened is narrow, the pour will be less than approximately 100 CY, and the maximum dead load deflection is less than 1"; then the entire continuous unit can be poured in one pour.
c) Post-tensioned cast-in-place concrete box girders; the pour strip should not be poured until the box has been prestressed, the falsework removed, and some time to allow for creep (one month) has passed.

Otherwise pour strips are not required and not recommended because a simple construction joint can be used. Try to keep pour strips out of the wheel path of traffic since this would make for a rough ride.

3.2.2 Transverse Joints

For simple span construction a transverse joint is required in the deck at each bent where the deck is continuous (otherwise an expansion joint would be used). While there are No. 6 bars that make the deck continuous, the deck will crack along the centerline of the bent anyway. Therefore a shallow saw cut joint is required to control cracking. This is part of the Detail A cell that goes with all edgebeam cells.

3.2.3 Longitudinal Joints

The preferred placement for a longitudinal joint (for staging) is along the edge of the top flange of a PSC beam. Do not place a longitudinal construction joint within the limits of the bridge flange since water could be trapped in the joint and freeze.

3.3 Expansion Joints

Expansion joints are to be kept to a minimum because they always seem to leak or otherwise cause maintenance problems. However they are unavoidable on bridges longer than about 400 feet and therefore are common.

3.3.1 Silicone Joint Seals

This is the old standard joint. However it is no longer used on bridge decks except at the ¾ inch joint at the end of the bridge between the bridge deck and the approach slab. This joint is detailed in the approach slab standard. Eventually, this standard will be changed and the silicone joint will be replaced by an Evazote joint.

A silicone joint can be compressed to half of its original size. Therefore these are usually designed by taking the total expansion length of superstructure times a 40-degree temperature drop times the modulus of expansion for concrete and multiplying by two to come up with a nominal joint size.

3.3.2 Evazote Joint Seals

The Evazote joint is the preferred type of expansion joint for bridge decks. Evazote is the brand name of a light foamy plastic joint filler. The generic name is closed-cell polyethylene seal and described in spec section 449.2.D. It is preformed but can be compressed and stretched easily. It is glued in place into a clean joint between two concrete decks. It is not a pay item except when it is used as a joint replacement on an existing bridge.

The maximum allowable size of an Evazote expansion joint after all deck contraction has occurred is 3 ¼ inches. To calculate the seal size, add together the distances to the last fixed joint back and the next fixed joint ahead and multiply the total by 70 degrees times 0.000006 times 12 to get it in inches. Then go into the table below and pick a joint that will take that range of expansion (for instance, 150 feet back and 200 feet ahead give 1.764 inches, so use the E 2.1875):

Product	Opening at 60°	60% compression	30% tension	Range	Size WxH
E 1.00	0.75	0.40	1.30	0.90	1" x 1"
E 1.25	1.00	0.50	1.63	1.13	1.25" x 2"
E 1.875	1.50	0.75	2.43	1.68	1.875" x 2"
E 2.1875	1.75	0.88	2.85	1.97	2.1875" x 2"
E 2.50	2.00	1.00	3.25	2.25	2.5" x 2"

The plans should show joint openings for 30, 60, and 90 degrees to (the amount for 90 degrees will be the 60% compression size from the chart). The maximum allowable range is 2.25 inches (though Maintenance uses larger ones and essentially any size can be made by cutting the material to the correct size). The joint is illustrated on the plans using a standard cell which must be changed to reference section 449.2.D of the Standard Specifications. Also include the seal size prior to installation (in the last column above) so the contractor will know what size product to order.

By the current approach slab standard, the joint at the end of the bridge is a conventional ¾ inch silicone expansion joint. However, if the distance to fixity exceeds 130 feet, an Evazote joint should be used, with a minimum size of 1 inch. This can be calculated or you can use the table below as an approximate guide:

Dist. to fixity (ft.)	Evazote Size	Joint size at 60 degrees (in.)
140-210	E1.25	1.00 (use 1.25)
220-230	E1.875	1.25
240-260	E1.875	1.5

The joint at the end of the bridge is shown for an opening of 60 degrees without a temperature table. A general note must be added modifying the standard and the plans should include a detail with a cross-section of the joint including opening size and the size of the material. Joint sizes of up to 1.75 inches (distance to fixity of 380 feet) can be used with permission of the Bridge Office.

3.3.3 Strip Seal Expansion Joints

Anything beyond the capacity of an Evazote joint will need to be a Jeene-type joint using our standard detail and pay item for elastomeric profile joints (Evazote joints are incidental). Because this type of joint is more expensive, try to space your expansion joints so that you can use Evazote.

3.3.4 Longitudinal Expansion Joints

Expansion joints in the longitudinal direction of the bridge are rare, but should be used on very wide bridges (width > 150 feet). Do not detail an open longitudinal joint where bicycle traffic is expected since it can catch narrow bicycle wheels.

In urban areas and on high-volume routes where traffic will stand on the bridge (e.g. a traffic signal located near the ends of the bridge), a 1-inch longitudinal joint shall be used at the high point of the crown on steel beam bridges so that vibration caused by traffic moving on one side of the bridge will not be felt by traffic sitting on the other side of the bridge. Longitudinal joints shall not be placed in locations where water will run across the joint. The joint shall be sealed with a closed-cell polyethylene seal (Evazote). Do not include a pay item for the seal.

3.4 Barriers, Railings, Sidewalks and Medians

3.4.1 Barriers

3.4.1.1 General Requirements

Bridge barrier shall be concrete bridge barrier or concrete parapet with one or two pipe handrail in accordance with this section. Aesthetic barriers, where applicable, may be used with the prior approval of the State Bridge Engineer.

Bicycle Routes
In the Preliminary Layout phase, the Designer shall check with the Project Manager to determine if a bicycle route is present at the bridge location. The Designer shall coordinate with the Project Manager to provide any additional bridge width necessary to accommodate the bicycle route, and should obtain a letter from the Project Manager stating the presence of the bicycle facility.

3.4.1.2 Geometry

Railing geometry shall be determined as follows:

Bridges without sidewalks on non-bicycle routes
Provide a 32" high concrete bridge barrier with a 9" top. Generally this is a jersey shape, but if the roadway uses a different shape, the bridge should match the roadway.

Bridges without sidewalks on bicycle routes
Provide a 32" high concrete bridge barrier with a 13" top and one pipe galvanized steel handrail with the posts embedded in the top of the barrier similar to fence posts for a total railing height of 3'-6". Maximum post spacing is 8'.

Bridges with sidewalks
Provide a 2'-3" parapet and the Georgia Standard 3626 one rail aluminum handrail, for a total railing height of 3'-6" measured from the top of the sidewalk, in accordance with the AASHTO Specifications. This detail is also used when a bicycle route is present, whether the bike traffic is on the road or on the sidewalk. See fence requirements below.

Bridges over Interstate, Limited Access Highways and Railroads
If a sidewalk is present, the bridge is in an urban area, and the bridge is over an interstate or other limited access highway, use a 2'-10" high parapet and a chain link fence. All bridges with sidewalks that are over railroads use a 2'-10" high parapet and chain link fence.

If a sidewalk is not present, but the bridge is over an interstate highway in Atlanta, a fence will probably be required on top of a barrier with a 13" wide top. Get guidance from Bridge Design if this situation arises.

Architectural rails

Sometimes in historic areas, an architectural rail is required. The Texas rail can be used where there is a sidewalk, but has only been crash tested for speeds less than 45 mph. The Kansas corral can be used up to 55 mph. Because of the expense of these rails, use them only with permission of the Bridge Office.

3.4.1.3 Detailing

Endposts
The endpost on the bridge superstructure shall be paid for in the quantities for lump superstructure concrete and bar reinforcement. When the endpost is on the superstructure, details for the reinforcement need not be shown, but the weight of the bar reinforcement must be included in the quantities. If the endpost is an integral part of the substructure, the quantities shall be included in those for the substructure elements of which they are a part. Details of the reinforcement should be shown and the quantity included in the quantity for the substructure element. On the superstructure or substructure details, as appropriate, refer to Standard 3054, and specify the length, width and height of the endpost under Bridge Consists Of in the General Notes.

Expansion Joints
Expansion joints in parapets and barriers shall be placed at a maximum spacing of 25' but not less than 15', except for T-beam spans, where a joint shall be placed at the mid-span. Expansion joints in parapets and barriers shall be placed at deck construction and dummy joints and at intermediate bents.

Concrete Bridge Barrier
Details for concrete bridge barrier shall be placed on the bridge plans. The top dimension should be changed to 13" when necessary to accommodate a fence, railing or glare screen.

Stirrups in the barriers are usually placed at every other main transverse deck bar but the spacing shall not exceed 12".

3.4.2 Sidewalks and Medians

3.4.2.1 General Requirements

Sidewalks shall be used on all bridges where the approaching roadway section has curb and gutter. Except where required in special cases, all sidewalks shall be 5'-6" wide, measured from the gutter line to the face of the parapet. This accommodates a 5'-0" roadway sidewalk and incorporates a 6" curb. "Special cases" could include sidewalks where there is an excessive amount of pedestrian traffic (such as outside a sporting arena) or sidewalks where bicycle traffic is allowed on the sidewalk. The designer shall seek approval from the GDOT PM *before* proceeding with design of a sidewalk that is wider than 5.5 ft.

3.4.2.2 Geometry

Cross-slope on sidewalks shall be 1% except on the high side of superelevation, where the superelevation is steeper than 4%, the slope on the sidewalk should be increased to provide a minimum sidewalk thickness of 3½" at the face of the parapet.

3.4.2.3 Detailing

Joints
Construction joints shall be provided in sidewalks and medians at deck construction and dummy joints. Expansion joints shall be provided in sidewalks and medians at expansion joints in the deck.

Removable Sidewalk and Median Details
Where sidewalks or raised medians are required, they shall be detailed as removable.

3.4.3 Handrailing

3.4.3.1 Aluminum Handrail Post Spacing

Handrail post spacing for aluminum handrail shall be in accordance with Georgia Standard 3626 (one pipe aluminum handrail) or 3632 (two pipe aluminum handrail). 3632 railing is used only in very rare instances and by permission of Bridge Design. Post spacing shall meet the following requirements:

a) No space greater than 8 feet.
b) There shall be two end spaces adjacent to the “Y” segment (see standards); these spaces shall each be no greater than 4 feet.
c) The minimum distance to a joint in the parapet only is 1’-6”.
d) The minimum distance to a joint in the parapet that is also at a deck construction or expansion joint is 3’-0”.

The following are desirable characteristics:

a) Other than end spaces adjacent to the “Y” segment, the maximum change from one space to the next should be 1’-0”.
b) End spaces adjacent to the “Y” segment should be approximately one-half of the length of the first full space.
c) The minimum post spacing should be 6’-0”.
d) 1’-3” =< “Y” =< 2’-0”
e) Of the desirable characteristics, items a, b, and c should be adhered to except when it is impossible; item d can be violated, but in any event, “Y” should be >= 0’-9” and <= 2’-3”.

It is advantageous to arrange the post spacing and the parapet joint spacing at the same time, rather than selecting the parapet joint spacing and then trying to fit the post spacing to it. Joints in sidewalks have no bearing on the post spacing.

3.4.3.2 Modification of Existing Aluminum Handrail

When doing any work on an existing bridge with aluminum handrail where the handrail is to remain, the handrail shall be modified to bring it up to current standards, if necessary. The existing bridge plans should be checked to be sure that:

1. The railing is anchored to the endpost
2. The spacing of the posts in the first two spaces adjacent to the endpost should not exceed 4'-0". If either of these conditions is not met, details shall be included in the Plans to accomplish them.

3.4.3.3 Chain Link Fence

Where required, chain link fence used as vandal protection on bridge parapets shall be galvanized fence fabric with 2" square openings.

Post spacing for chain link fence shall be shown on the plans and shall be so arranged that there are no posts with their center within 1'-0" of an expansion or construction joint in the parapet or barrier.

Epoxy coated chain link fence is not allowed.

3.4.4 Temporary Bridge Barrier

Where required for traffic control for staging or widening all temporary barrier will be paid for as Method 1 or Method 2. Method 2 shall be used when there is less than 6' from the center line of the barrier rail to the edge of the deck. Method 1 shall be used otherwise. Because this new type of barrier is not covered in the Specifications, a Special Provision is required for either method. Assume a 2.5' wide barrier in configuring lane widths

Method 1
This method requires the contractor to provide, use, relocate and remove the temporary barrier according to applicable Plan dimensions and locations in accordance with Georgia Standard Specification 620. The barrier remains the property of the contractor.

When using Method 1 be sure to add the following note to the General Notes:

> TEMPORARY BARRIERS, METHOD 1 – PLACE TEMPORARY BARRIERS AS SHOWN ON THE PLANS AND GEORGIA STANDARD NO. 4960 TO PROVIDE FOR TWO 12'-0" TRAFFIC LANES. SUPPLY AND USE THE BARRIER IN ACCORDANCE WITH SPECIAL PROVISION SECTION 620.

Method 2
This method requires the contractor to furnish barrier that is certified to meet NCHRP 350 standards for impact testing. This method includes positive connectivity of the barrier to the deck, which typically involves anchoring the barrier to the deck using through bolts. Therefore do not place the traffic face of the barrier over a beam flange. This should be identified early in the design since it could affect staging or beam spacing.

When using Method 2 be sure to add the following note to the General Notes:

TEMPORARY BARRIERS, METHOD 2 – PLACE TEMPORARY BARRIERS AS SHOWN ON THE PLANS AND GEORGIA STANDARD NO. 4960 TO PROVIDE FOR TWO 12'-0" TRAFFIC LANES. SUPPLY AND USE THE BARRIER IN ACCORDANCE WITH SPECIAL PROVISION SECTION 620.

When preparing bridge plans where temporary barrier is to be used, the following procedure shall be followed:

1. Estimate the quantity needed. Refer to Ga. Std. 4960 for allowable taper rates.
2. Request that the Roadway Project Manager include that quantity in the roadway plans and quantities.
3. In the event that quantities cannot be shown on the roadway plans, the quantity required should be shown in the Bridge Plans Summary of Quantities under Pay Item 620-0100 Temp Barrier Method No 1 or Pay Item 620-0200 Temp Barrier Method No 2; the units are linear feet.

3.5 Deck Drainage

Bridge designers shall ensure that the bridge deck will freely drain water to minimize gutter spread or ponding. This is normally accomplished with a 2.0% normal crown, and 4" diameter bridge deck scuppers spaced at 10'-0" centers along the gutter line. The beam spacing on some wide-flange beam bridges will interfere with the placement of scuppers. In this case, scuppers may be replaced with 3"x6" open slots in the bottom of the barrier.

Avoid bridges on 0% grade since they do not drain very well.

On super-elevated structures the scupper spacing may need to be tightened to 5'-0" centers to assure adequate drainage.

Scuppers shall **not** be located within 5'-0" of the BFPR or centerline bent, over non-rip-rapped end fills, railroads, or traffic lanes.

Location of the low-point of a vertical curve on a bridge or approach slab is strongly discouraged, and should only be considered when there is no feasible alternative. Before proceeding with a design that has a low point on a bridge or approach slab, the designer should consult with the Roadway Designer and then the Front Office to confirm that no other feasible option exists.

When a low-point is located on a bridge, it shall not be located within 10'-0" of the BFPR or centerline bent, and scupper spacing shall be reduced to 2'-6" centers within 10'-0" of the low point.

For more details on deck drains and drainage, see Chapter 15 of the GDOT drainage manual.

When drainage of the deck is required and can not be accommodated by conventional scuppers or barrier openings, a deck drainage system is required. The deck drain system shall be made of ductile iron and/or PVC pipe Schedule 40 and consist of scuppers, drain pipes, clean-outs, and downspouts. The Office of Road Design will perform a bridge deck hydraulic study at the request of Bridge Design. The request should include the bridge Plan and Elevation, Deck Plan, Deck Section, roadway plan and profile sheets, and details of any preferred drainage structures.

Scuppers should be spaced along the bridge as per the deck hydraulic study. Scuppers should have a steep sloped bottom because it is self-cleaning. Outlet should be 5 inches minimum and preferably 6 inches in diameter. The drainage grate must be bicycle safe. See Neenah product number R-3921-V1 for an example of an acceptable bridge scupper. Increase the depth of the deck to get reinforcement under the drain and around the outlet.

The scupper will connect to a drainage pipe of a size and slope calculated in the deck hydraulic study. Where the underside of the bridge is visible, longitudinal drain pipes should not be attached to the overhang, but instead shall be placed in a bay between beams. Include cleanouts at each drain location and near each bent including end bents. The drainage pipe may or may not connect to the downspout (the system must accommodate any differential movement between the pipes attached to the superstructure and the downspouts attached to the substructure). Downspouts may be placed at intermediate bents and drain into roadway ditches or drainage structures. Downspouts may be cast into the substructure or may be attached to the outside. Do not attach downspouts to the traffic face of a column.

3.6 Utilities on Bridges

3.6.1 General

When facilities for utilities are to be placed on bridges, the Designer shall request that the Office of Utilities contact the utility and request that they submit the following information:

1. Descriptions (e.g. 10” water main, four 6-inch diameter telephone conduits)
2. Owner (e.g. Early County Water System, BellSouth)
3. The weight of the utility per foot including contents
4. The opening size required through endwalls, backwalls, edge beams and diaphragms
5. For water and sewer mains, the maximum diameter of the pipe bell or flanges
6. The hanger spacing (actual or maximum)
7. Hanger details if a particular hanger system is desired
8. Location on the bridge (right side, left side)

Utility conflicts must be handled in the design of the bridge or by relocation of the utility. Notifying the contractor that a conflict exists via a note in the plans is not acceptable.

Utilities must be fully enclosed within a bay and must not hang below the bottom of the lowest beam.

Utilities that are too heavy to be suspended from the deck shall be supported by channels bolted to the adjacent beams, as shown in the standard cells. These utilities shall not be located in exterior bays where the supporting hardware will be visible outside the fascia beam.

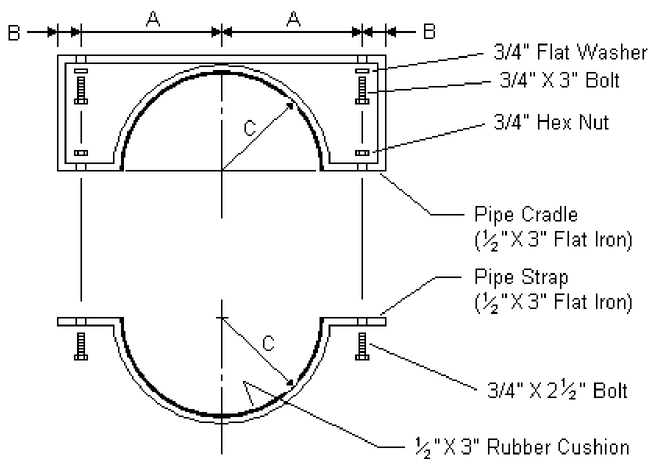
In lieu of more accurate weights provided by the utility, these loads are provided from the BIMS manual:

Water/Sewer Mains	
6”	41 lbs/ft
8”	60.1
10”	87.1
12”	118.8
16”	194.4
30”	472.3

Gas Mains	
2”	3.66 lbs/ft
4”	10.8
6”	19.0
8”	22.4
10”	28.1
12”	32.4
16”	47.0

Weight of communication conduit can be estimated at 9 lbs/ft per duct.

Note: For City of Atlanta Bureau of Water requirements, see Figure 3-1 and Figure 3-2.



PIPE SIZE	A	B	C RADIUS	PIPE WEIGHT PER FT. WITH WATER
8"	6.53	2.00	4.53	62 lbs
12"	8.60	2.00	6.60	119 lbs
16"	10.70	2.00	8.70	195 lbs
20"	13.00	2.00	11.00	250 lbs

Atlanta Water Works Pipe Saddle

Figure 3-1 Water main saddle details

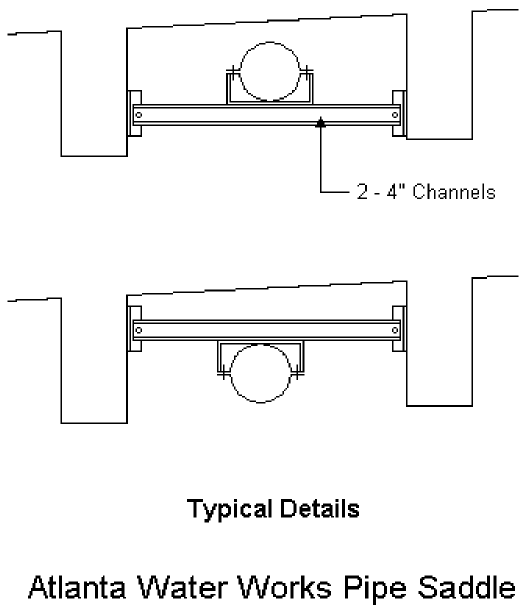


Figure 3-2 Water main hanger details

3.6.2 Designation of Utility Owners on Bridge Plans

All Bridge Plans shall have the caption, UTILITIES added to the Preliminary Layout or General Notes sheet in a manner similar to BRIDGE CONSISTS OF, DRAINAGE DATA, etc. and list underneath the names of all utility Owners of utilities that are located on the bridge. Do not list utilities, which are in the vicinity of the bridge but are not located on the bridge.

If a future installation is proposed, the Designer shall indicate this by placing “(Future)” after the name of the Owner. If there are no Utilities, it shall be indicated by placing “(None)” after the name of the Owner.

These requirements are in addition to all details, dimensions, etc., necessary to locate and support the Utility on the Bridge.

3.6.3 Hangers For Electrical Conduits

Hangers for electrical conduits on bridges shall be specified at a maximum spacing of 10’-0”.

3.6.4 Revisions to Utilities

The Designer shall send any revisions to the Plans dealing with Utilities through the normal revision channels and to the District Utilities Engineer. The Designer shall also ensure that the Utility Company is made aware of the changes.

3.6.5 Gas Lines on Post-Tensioned Box Girders

See Section 3.14.8.

3.6.6 Permits for Bridge Attachments

See MOG 6850-11. Contact the Office of Utilities.

3.7 Edge Beams

Edge beams shall be used at the discontinuous edges of the deck. Stirrups in the edge beam shall extend into the deck.

Whenever possible use the standard cells for size and reinforcing of edge beams.

However, whenever adjustment of edge beam depths are necessary to clear utilities or match an adjacent span, edge beams shall be designed and detailed using a minimum depth below beam flange of at least 18 inches.

When contractors substitute precast stems or beams for cast-in-place RCDG stems, make certain that edge beams at the ends of spans are in conformance with these details.

When replacing existing edge beams on existing steel beams and plate girders, and new holes must be provided in the existing beams for edge beam bars, place a note on the plans the contractor shall <u>drill</u> 3” holes at each bar location.

For stage construction be aware of possible conflicts due to bar laps sticking out of the edge beam. Call for bar couplers if there is a conflict. Couplers are not paid for separately but do require a Special Provision.

The web of a PSC beam should be entirely within the edge beam. Increase the thickness of the edgebeam if necessary (for very severe skews).

In visible areas make sure the edge beam is flush with the exterior beam face all the way to the bottom of the beam to give a smooth continuous look to the beams. Add a No. 4 rebar 5-ft. long just below the top flange of the exterior Bulb Tee beam and a vertical bar along the CL beam with a 90-degree bend over the top of the beam to reinforce the concrete in the flush edge beam. In the exterior bay, detail a fillet in the bottom of the edge beam to the top of the bottom flange of the exterior beam. The slope is 1:1. This is done to make sure the concrete can flow into the bottom flange area of the beam.

Because T-beams are constructed span-by-span it can be difficult to install transverse 800 bars in the edge beam with the 600 continuity bars in place from the previous span. Therefore add the following note to the deck section sheet when you have t-beam spans with continuity steel: “At contractor’s option, 800 bar in edge beam may be spliced. One 5’-0” lap splice will be allowed at CL bridge. No additional payment will be made for optional splices.” If there is a beam at the CL bridge, modify the note to locate the splice between beams.

3.8 Endwalls

Endwalls shall be provided at the end bents to provide retainage of the fill below the approach slab and between the beams.

Endwalls typically run the full length of the end bent cap, and ½ the width of the end bent cap (18” minimum) at interior bays and the full width of the cap at exterior bays. Although there is a cell for an 8” fixed endwall (usually only happens with one-span bridges), the current preference is to use an 18” endwall even at fixed bents for PSC beam bridges.

See the standard cells for typical endwall reinforcing. See 3.7 for guidance on use of bar couplers with staged construction.

At expansion end bents with endwalls, the cap steps are rarely skewed (see 4.2.2). However, in less extreme cases some movement of the endwall can be accommodated by increasing the thickness of the preformed joint filler in the vertical joint between the cap step and the endwall.

3.9 Diaphragms and Cross Frames

Diaphragms for concrete girder bridges shall be specified in accordance with AASHTO Section 9.10 and detailed in accordance with the Standard Details. Steel diaphragms are not allowed.

Diaphragms or Cross Frames for steel girder bridges shall be designed in accordance with Section 3.13 of this Manual, AASHTO Section 10.20, and in accordance with the Standard Details.

Where necessary, X-type cross frames are preferred.

In cases where lateral bracing is required by the AASHTO Specifications, to protect webs of girders from stress due to fatigue and out of plane bending, do not weld lateral bracing gusset plates to the web. A suggested alternative is to shop bolt an angle to the web with a gusset plate either shop welded or bolted to the outstanding leg of the angle, with the angles of a lateral bracing system field welded to the top side of the gusset plate.

On skewed bridges, diaphragms must be located so that a line through the beam midpoints crosses the diaphragm at mid-bay. The result of this is that a beam with two sets of diaphragm holes will have the holes spaced the same distance from the midpoint of the beam. When bridges are skewed, but on a tangent section of roadway, you can usually show the distance to the diaphragms on the deck plan sheet.

The designer shall provide a positive support system for the crossing of the lateral bracing diagonals in order to limit upward and downward deflection of the brace system due to live load deflections on the bridge. This may be accomplished with inserts in the slab with hanger rods to the bracing, or hangers from some other structural element installed specifically for that purpose

Bracing for Exterior Steel Beams - Due to problems with exterior beams buckling during deck pours, the following note shall be placed on the deck section sheet for bridges with steel beams or girders:

“The Contractor shall provide bracing between the exterior beam (girder) and the first interior beam (girder) until the deck has been poured, the overhang forms have been removed and the diaphragms (cross-frames) have been welded. All costs for designing, providing, installing and removing bracing shall be included in price bid for Lump – Structural Steel.”

3.10 Bearings

3.10.1 General

The general preference for bearing selection is as shown in Fig. 3.10.

	d	RECOMMENDED BEARINGS	COMMENTS
T beams and Type 1 Mod beams	0-40’	U	
T beams and Type 1 Mod beams	40 – 160	R	For d in excess of 160’ bearings typically become unstable in sliding.
AASHTO & Bulb T beams	40 - 200	R	Limited by length of chase, seismic shear on dowel, beam stability
Steel Girders	0-50’ 50-160’ 160’ up	R, SB R, SBL P	
Steel Beam Widenings			Widen “in-kind”

Glossary

d: Length in feet from point of fixity to bearing
U: Plain Elastomeric Pad
R: Steel reinforced elastomeric bearing
SB: Plate bearings (sole and bearing plates only)
SBL: Plate bearings (exp ends use sole, brng, & lube plate)
P: Pot Bearing

Figure 3.10 Normal Bearing Selection by Bridge Type and Span

Use of alternate bearings than those shown shall be submitted for approval to the State Bridge Engineer at the start of the design process. The Department has no standard details for reinforced elastomeric pads under steel beams.

3.10.2 Elastomeric Pads

General
Elastomeric pads should be rectangular and should be placed flat and perpendicular to the beam centerline. Neoprene bearing pads with 3” (75 mm) diameter holes for smooth dowel bars shall be used for PSC beams. The width of the pad shall be at least 2” narrower on each side than the nominal width of the bottom flange of Type III and larger PSC beams and at least 1” narrower with smaller PSC beams, T-beams and steel beams. This will allow for beam chamfers, tolerance in fabrication of the beam, and the use of a shim plates if necessary (see section 3.10.4). Plan dimensions are incremented by whole inches. The use of tapered pads is prohibited.

End bent and intermediate bent caps should be of sufficient width to provide adequate clearance from the edge or end of the cap to the neoprene bearing pads (see Section 4.3.2.1). This should be checked when contractors submit redesigns of cast-in-place T-beams to precast beams.

Anchorage for P.C. Girder Bridges
One bent cap to superstructure connection within a continuous deck unit shall be “fixed” by the provision of a single steel pin centered at a 3” diameter hole centered on each bearing. The pin shall be a 1 ¼” diameter smooth dowel to ASTM A709 Grade 36 cast into the bent cap and engaged in a nominally oversized hole in the beam.

All other substructure/superstructure interfaces shall be nominally expansive and the single steel pin should be centered on each bearing, cast into the bent cap and engaged in an oversized slotted hole or chase in the beam. Pins shall be sized to ensure 2” nominal vertical clearance between top of pin and recess in the girder.

Detailing
See the standard sheets for detailing of Elastomeric Bearings. Note that sealing ribs shall be used with precast beams and should not be used for cast-in-place beams.

Unreinforced (Plain)

Unreinforced Elastomeric Pads shall be provided for T beams and Type I Modified Beams where the distance from the bearing to the point of fixity is 40’ or less. The pads shall be 9”x16”x ½”, (60 durometer) and no further analysis is required. A note shall be placed on the bearing sheet instructing that if the Contractor redesigns a T-beam bridge to use precast beams, bearing pads shall remain as shown on the Plans.

When widening or paralleling T-beam bridges, the designer shall review the existing bridge condition survey and make a physical inspection of the existing bridge in order to make a recommendation for the need to install neoprene pads under the existing beams. If this recommendation is agreed to by the State Bridge Engineer then 9”x 14” x ½” unreinforced pads with slots to pass around the dowel bar shall be specified. Pay item 518-1000 – Raise Existing Bridge, Sta. – should be included in the Summary of

Quantities to cover all costs for supplying and installing these pads. This requires a Special Provision.

Steel Reinforced

General
Steel Reinforced Elastomeric bearing pads are preferred for use with prestressed concrete beams, steel plate girders, and longer continuous t-beam bridges. Use GDOT program BRPAD1. A note shall be placed on the bearing sheet that if the Contractor redesigns a T-beams bridge to use precast beams, the designed pads shall be redesigned accounting for the new loads and rotations in accordance with this section.

Design Method
Bearing Pads shall be designed in accordance with AASHTO 14.6.6 Elastomeric Pads and Steel Reinforced Elastomeric Bearings – Method A except as follows:

Thermal Movement
Bearings shall be designed for thermal movements based on temperature rise of 30° F and temperature fall of 40°F above or below nominal setting temperature. No adjustment shall be made for actual or anticipated setting temperature. By default BRPAD1 uses a 70° temperature range so the distance to fixity in that program should be reduced to 4/7 of the actual.

Material Properties
The Shore durometer hardness should be 60 and the shear modulus shall be 130 psi (min) to 200 psi (max).

Combined Compression and Rotation
Bearings shall be sized such that the total rotation in the bearing as given by the sum of:

- Rotation due to superimposed dead load deflection
- Rotation due to live load deflection
- Rotation due to beam camber (self weight + prestress + time)
- Bridge grade (unless shims are used)

Shim Plates

If the combined compression and rotation criteria requirements cannot be met, and/or if the longitudinal grade is too steep, galvanized steel shim plates shall be used. If steel shim plates are used they shall be 0.25" minimum thickness with the thickened side specified to the nearest 0.125". These shims shall be 2" larger in each plan dimension than the pad and shall be placed on top of the pad.

3.10.3 Pot Bearings

Required capacity, translation and rotation for bearings shall be provided by the designer. Bearing seat elevations will be calculated and provided based on the assumed height of the bearing assembly shown on the plans. A note shall be provided requiring the contractor to design the bearing in accordance with AASHTO criteria and to provide shop drawings for the bearings and for changes to bearing seat elevations based on the actual height of the bearing assembly to be furnished as follows:

> ***Elevations shown for the top and bottom of the cap are based on the "X" dimension shown on the Pot Bearing Details sheet. These elevations shall be adjusted by the Contractor to account for the actual height of the pot bearing to be used. Bent cap concrete shall not be poured until the pot bearing shop drawings have been approved and necessary adjustments have been made.***

The Plans shall show a 1/8" elastomeric pad under the bearing in lieu of the cotton duck called for in the Standard Specifications. The pad should be 50 to 60 durometer hardness neoprene and be 1" larger than the base plate in each plan dimension. A note should be added to the plans that all costs for supplying and installing this elastomeric pad should be included in the price bid for Lump – Structural Steel.

3.10.4 Self Lubricating Bearings

See the following design chart for the sizing of self-lubricating bronze plates.

Size (in)			Maximum Load (kips)		
Length	Width	Thickness	With 2 Slots 3 x $1^3/_{16}$	With 2 Holes $1^3/_{16}$ Dia	Plain
10	7	1			140
10	8	1¼			160
10	9	1¼			180
10½	7	1			147
10½	8	1¼			168
10½	9	1¼			189
12	6	1	131	140	144
12	7	1	155	164	168
12	8	1¼	179	188	192
12	9	1¼			216

Use only plate sizes shown, sized for the maximum service design load.
Dimensions in inches, loads in kips.

Design Specification: Bronze plates shall conform to ASTM Designation B 22, Alloy UNS 91100 and shall have an allowable unit stress of 2000 psi in compression.

Limitations: Sliding plate type bearings shall not be used where the anticipated total movement (expansion plus contraction) exceeds 3 inches for assemblies without anchor bolts through the flange and 2 inches for assemblies with anchor bolts through the flange.

When the gradient of the girder at the bearing exceeds 4.0%, the top of the upper plate (sole plate) shall be beveled to match the girder gradient.

Coefficient of friction: For design purposes, a value of 0.10 shall be used.

3.10.5 Anchor Bolts

Anchor bolts and anchor rods (used with pot bearings) shall be stainless steel, ASTM A 276 Type 304. On bridge widening or jacking projects, any new or replacement anchor bolts shall also be stainless steel. Requirements of Seismic Category A and B apply.

3.11 T-Beams

T-beams can be designed using BRSPAN (which also designs simple steel spans) but it uses allowable stress design. Unlike the deck design, the design of the T-beam does not require allowable stress design. Therefore use BRSPAN to generate dead and live loads and then factor these in a spreadsheet and come up with a design based on load factor design. Typically the result is eight main reinforcement bars which are No. 10 or 11 bars. The bottom 4 bars are usually full-length and hooked while the other 4 are shorter (to avoid conflict with the hooks) and straight (some people take it further and make 2 of those 4 bars even shorter). Due to the number of reinforced beams on the entire bridge, the reinforcement cost can be significant so it needs to be designed. Likewise try and get some kind of balance with your stirrups regarding bar cutoffs and capacities. Usually No. 4 bars are used as stirrups. On skewed bridges 3 stirrups with varying bottom widths are placed at the ends of the beam.

Try to keep beam spacing simple. For some common bridge widths, try the following “standard” spacing:

- **38-foot wide** 5 beams spaced at 8'-6"
- **40-foot wide** 5 beams spaced at 9'-0"
- **44-foot wide** 6 beams spaced at 8'-0"

On curved bridges T-beams can still be used but the bridge will most likely be redesigned to use Type I Mods. Though T-beams are cast-in-place, some contractors may opt to use a precast stem or even a prestressed stem.

A beam depth of 2’-3” from top of deck to the bottom of beam is used on spans of 30’ while 2’-9” is used on 40’ spans. There are separate cells for these at the endwall and edgebeam. No diaphragms are required per AASHTO.

There are special rules for bearing pads under T-beams, see section 3.10.

“T” Dimension: For T-beams you take the elevation of the deck where the CL beam crosses the face of cap *(not the CL bearing as with other beams*). Then you subtract the depth of T-beam (2'-3" or 2'-9") and the T dimension at the back of cap (this includes the bearing pad thickness). The T dimension is like a cast-in-place shim plate that goes from one face of the cap to the other. For tower bents where you might have a 5' wide cap, the T dimension can be substantial and so can the difference in the deck elevation between the face of cap and CL bent or bearing. It doesn't matter if you calculate the elevation at the back face of cap (on the back span) or the front face (on the ahead span) since you should end up with the same elevation (unless you are going to a different depth beam). The dimension includes the bearing pad thickness plus an additional ½” thickness for construction tolerance. The T dimension is detailed to the nearest eighth inch and there is no minimum difference before you detail different ahead and back T dimensions.

3.12 Prestressed Beams

3.12.1 Purpose

The purpose of this section is to establish the design criteria for precast, prestressed concrete beams used as primary load-carrying members in vehicular or pedestrian bridges.

3.12.2 Materials

3.12.2.1 Precast Concrete

Final Concrete Strength (Design Strength = f'_c)

The minimum strength of precast concrete to be used in beams is 5000 psi and the maximum is 8000 psi. Final concrete strengths shall be specified in 200 or 500 psi increments.
Note: Higher concrete design strengths up to a maximum of 10,000 psi will be considered for use in design upon the approval of the Bridge Office.

Release Strength (Initial Strength = f'_{ci})

The minimum release strength shall be 4500 psi.
The designer shall limit release strength to a maximum of 7500 psi (preferably ≤ 5500 psi) in order to facilitate standard fabrication schedules. The designer shall get the approval of the Bridge Office prior to utilizing release strengths higher than 6500 psi.
It is understood that the beams using design strengths over 8000 psi may also require higher release strengths.
Release strengths shall be specified in 100 psi increments.

Stresses

Prestressed beams should usually be designed with the allowable tension as specified in the AASHTO Specifications. These are:

$6\sqrt{f'_c}$ for normal exposure, and

$3\sqrt{f'_c}$ for severe exposure.

Normal-exposure criteria shall be used for all counties except the coastal counties, where severe-exposure criteria shall be used. These coastal counties are Chatham, Bryan, Liberty, McIntosh, Glynn, and Camden. The severe-exposure criteria shall apply to any bridge in a coastal county or which crosses the county line of a coastal county.

The allowable tension for which the beams are designed should be shown in the General Notes under Design Data if it is the same for all beams. Otherwise, the Design Data should reference the beam sheets, and the allowable tension should be shown on the beam sheets

3.12.2.2 Prestressing Strand

Use 1/2 inch diameter special low-relaxation strands by default. 0.6-inch diameter strand can be used when its use would eliminate a beam line or when absolutely necessary. All prestressing strands shall be the same size and type within any one PSC beam

Data for prestressing strands for use on PSC beam details sheets shall be as follows:

TYPE	SIZE English (in.)	AREA A^*_s (in^2)	FORCE P_{jack} (kips)
½" Regular	0.5	0.153	30.983
½" Special	0.5	0.167	33.818
0.6"	0.6	0.217	43.943

$P_{jack} = 0.75\ A^*_s f'_s$ where Low-relaxation strands, $f'_s = 270$ ksi

Detail all straight strands in 2-inch center-to-center grid, beginning 1" on each side of the centerline of the beam. Put two strands per row in the web since most fabricators are not set up to put single strands along the centerline of the beam (see Standard Beam Sheets for maximum strand patterns). In order to clear the 7-inch high dowel bar chase, do not use straight strands in the bottom 9 inches of the beam in the strand positions located 1" on either side of the centerline of the beam.

Use draped strands with the hold down point typically at the midpoint of the beam. Dual hold downs may be used if a single point will not work. Drape the strands located 1" on either side of the centerline of beam high enough to clear the dowel bar chase.

The use of debonded strands is prohibited.

3.12.2.3 Composite Slab Considerations

The design thickness of the composite slab shall be plan thickness less 1/4" of the top of slab (for grooving and possible planing). However, the weight of the 1/4" is to be included in the design loads. Where AASHTO allows 6 slab thicknesses overhanging the web, the web shall be taken as the top width of the beam for all of the standard shapes.

3.12.2.4 Precast Concrete Clearances

Concrete clearance in the web of precast beams is controlled by the following:

web width; shear stirrup size; size, number, and spacing of strands in the web.
All strands must always be contained within stirrups. This means that Bulb Tee and Type II beams will have only one inch of concrete cover in the web whenever No. 6 stirrups are used. (See Standard Beam Sheets)

3.12.2.5 Use of Fascia Beams

Fascia beams are recommended on bridges where a transition from a deep beam to a shallower one is in a visible area. Typically, this might happen on highway overpasses where the main span is long and the end spans are very short. Using exterior fascia beams on the short spans to match the long span beam gives the bridge a more uniform appearance. Fascia beams are not required on bridges crossing water or railroads.

3.12.2.6 Cheek Walls

If a fascia beam is not practical or it is desirable to conceal an area at a pier cap a 4" cheek wall built up from the pier cap to hide the joint can be used. Be sure the cheek wall is tucked as closely as possible (within 6 inches) of the beam, typically within the flange of a Bulb Tee girder.

Since the cheek wall is typically placed at the end of the cap and extends from cap face to cap face, a skewed cheek wall would then require the end of the cap would to be skewed too.

3.12.2.7 Design Issues

Horizontal dimensions of beams are not to be corrected for effects of vertical grades.

With AASHTO Type I through IV beams the design shall be based on having the top two strands fully stressed. Reduce the stress in the top strands only if necessary to make the beam work (not just to save strands in the bottom).

In wide-flange beams the design shall be based on a reduced tension in the four strands at the top of 10,000 lbs. minimum.

The Bridge Design Office has allowed the use of a 74-inch Bulb Tee with two inches added to the bottom flange to allow another row of strands. The fabricators indicate that the forms for this shape are on hand. Though spans longer than 150 feet are possible with such a shape, it is important to check if shipping such a long and heavy beam would be feasible. Therefore, the use of a 74-inch beam should be approved by the Bridge Design Office during early preliminary stages and should only be used to avoid a more expensive steel superstructure.

The Bridge Design reference website has dimensions and properties of this beam under English Beams as well as 54- and 63-inch Bulb Tees with thick flanges.

3.12.2.8 Stay-in Place Concrete Deck Forms

Stay-in-Place concrete deck panels are not allowed and no allowance shall be made for their use.

Stay-in-Place Metal Deck forms are used regularly and therefore the beam design shall include an additional 16 psf load to account for the concrete in the corrugations.

3.12.2.9 Programs

Use the Georgia DOT program BRPSBM1 to design beams.

Program Notes

“XDIST”: This amount should be a minimum of 7 inches, which is dictated by the fact that the beam needs to overhang the edge of the bearing pad by 2 inches for both AASHTO beams and Bulb-T’s.

“FT”: For Bulb Tees where you have the double fillet at the top of the web use a value of 2.43 inches to approximate an equivalent single fillet.

“DF”: This value increases the moment of inertia of the composite shape, so it is most conservative to use a value of zero. A higher value can be used if you know there will be extra coping at the center of the span (for instance for cross-slope across the top of the beam or when the minimum coping is at the ends of the beam).

Currently the prestressed beam program does not take into account the allowable stresses allowed by the current AASHTO specification. Instead it uses 0.6 of release and 0.4 of final all the time, which is acceptable and more conservative.

If you think the stresses are just barely out of the allowable, run an analysis of the beam to find out where the stresses are not working. If they are out by an insignificant amount you may use the beam anyway.

3.12.2.10 Standards

See Fig 3.12.2.10a for plots of Beam Spacing vs. Design Spans. These charts are to assist the Bridge Designer in selecting preliminary PSC beam spacing. Note that tension is allowed.

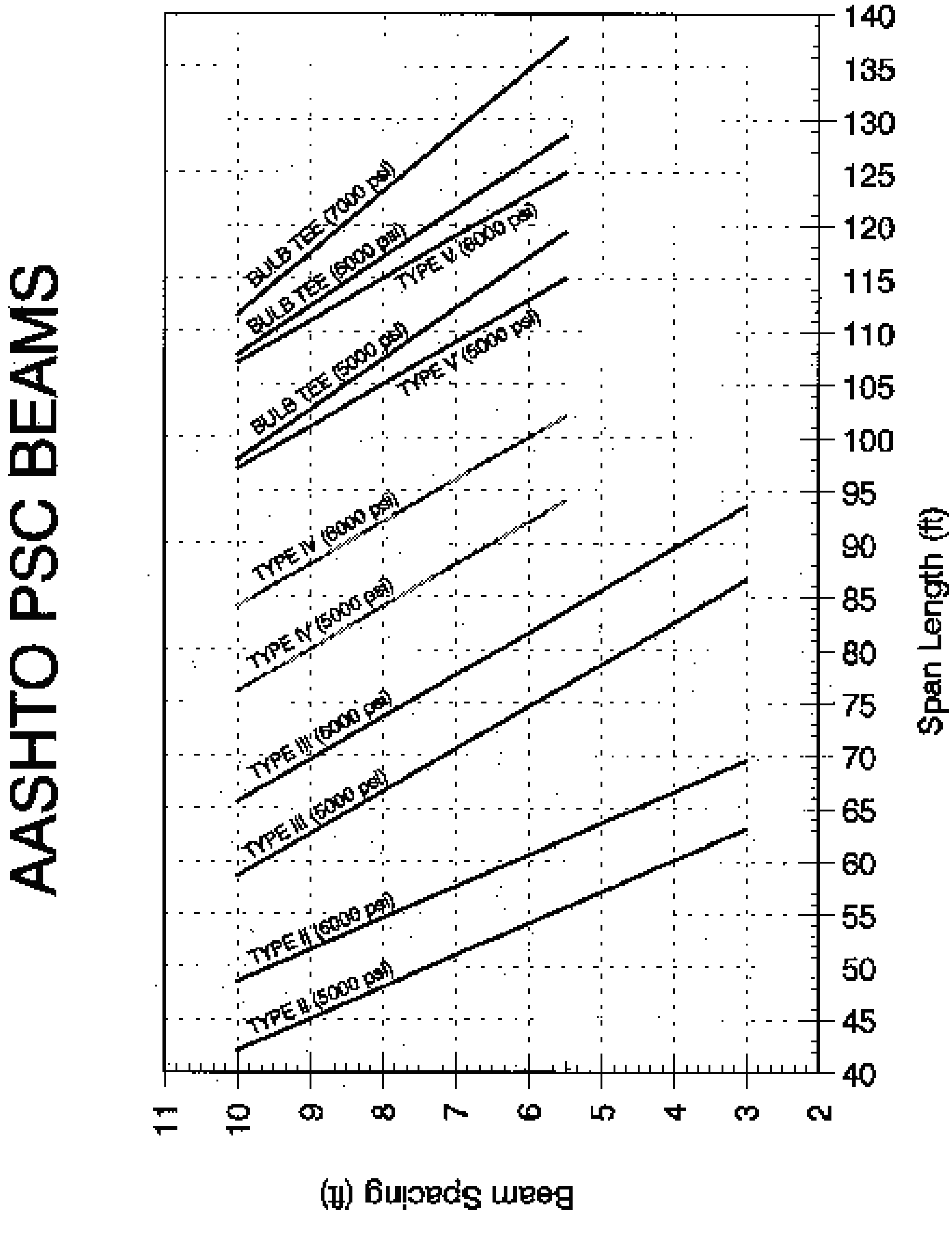


Figure 3-3 Beam selection chart

PSC Beam Charts

Beam Spacing (X-Axis) versus Maximum Design Span (Y-Axis)

Assumptions

1. Beam Spacing – 4.0' to 10.0' in .25' increments
2. Number of Lanes = 3, constant
3. Number of Beams = 6, constant
4. Slab was design using BRSLAB99 with 2½" cover
5. Maximum Design Span was determined using BRPSBM1
    a. Live Load: HS20 with Impact
    b. Concrete Properties
        i. $E_c = [(145)^{1.5}](33)[(f'_c)^{.5}]$
        ii. Dead Load = 150 pcf
        iii. Initial Tension in the Beam (SIT) = $6(f'_{ci})^{.5}$
        iv. Final Tension in the Beam (SIF) = $6(f'_c)^{.5}$
    c. Distribution Factor for Deflection = 1.000
    d. Composite Slab Properties – Depth of Coping (DF)
        i. 0.000, Type I MOD through Type IV PSC Beams
        ii. 1.000, Bulb Tees
    e. Non-composite Dead Loads (NCDL) – Coping
        i. [(1.5)(Top Flange Width)/144](.150), Type I through Type IV PSC Beams
        ii. [(3)(Top Flange Width)/144](.150), Bulb Tees
    f. One Diaphragm at Midpoint for all spans greater than 40'-0"

Type I MOD PSC Beam

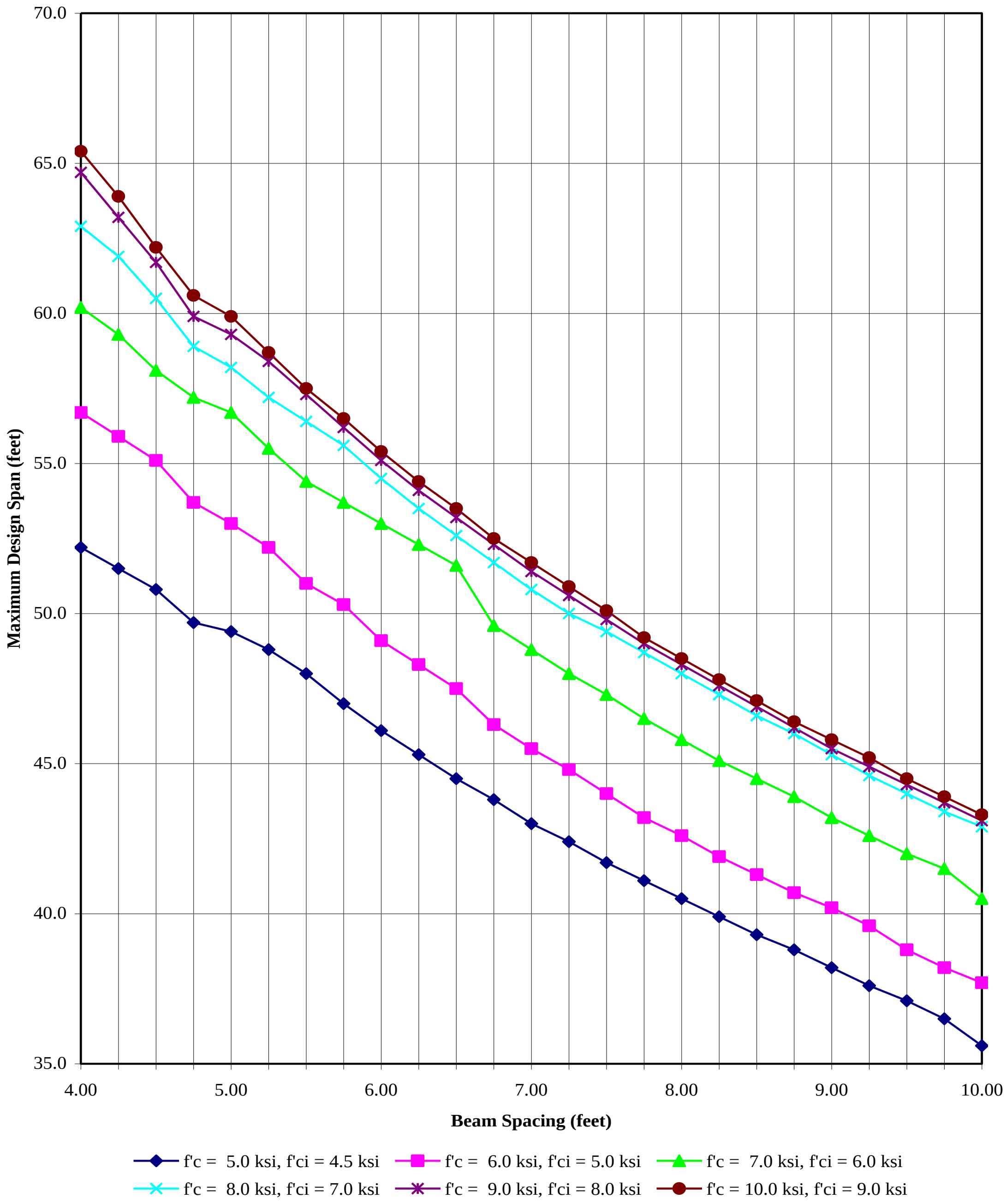


Figure 3-4

All strands are ½“ diameter low relaxation strands each stressed to 33,818 pounds.

Type II PSC Beam

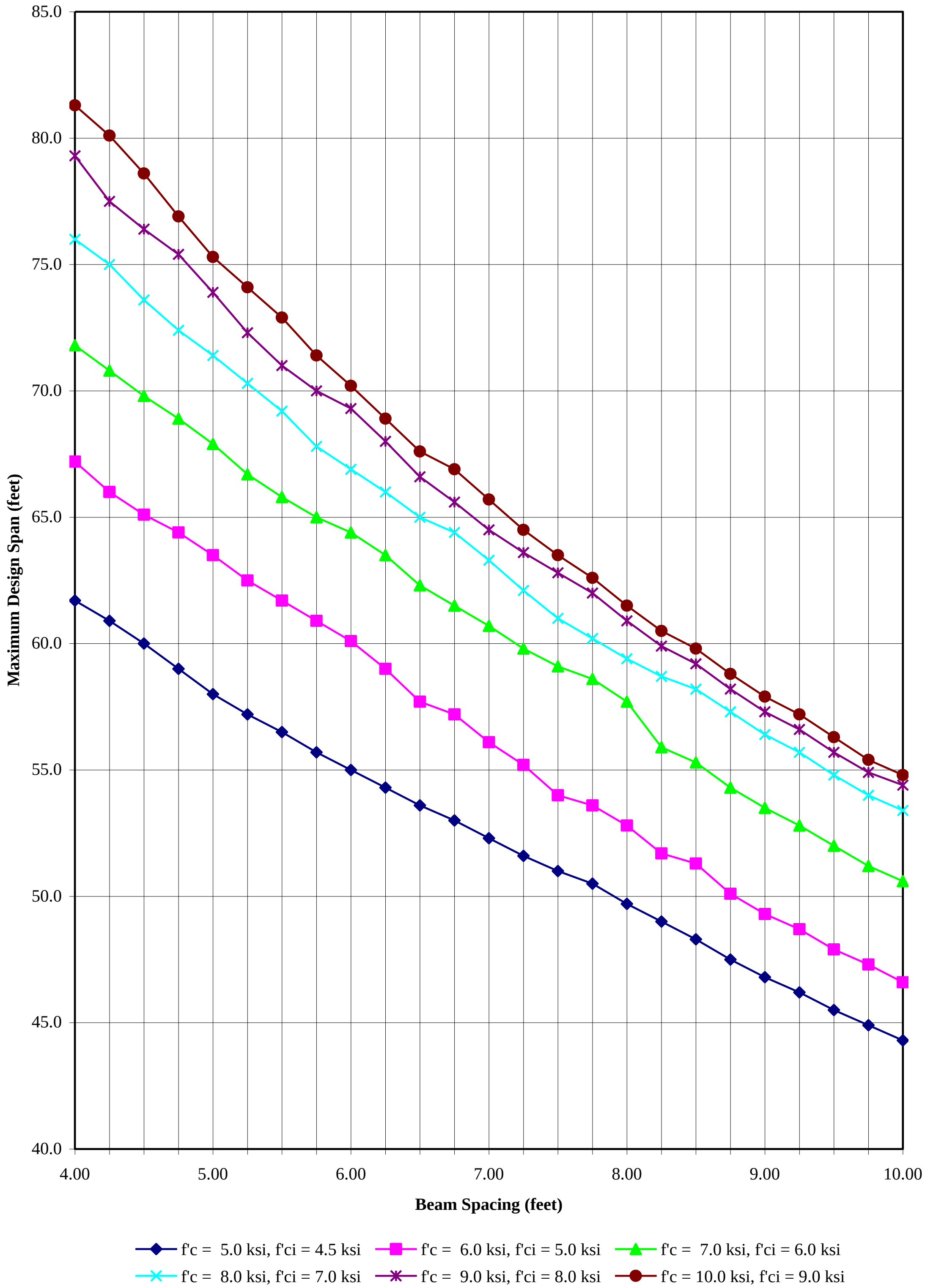


Figure 3-5

All strands are ½“ diameter low relaxation strands each stressed to 33,818 pounds.

Type III PSC Beam

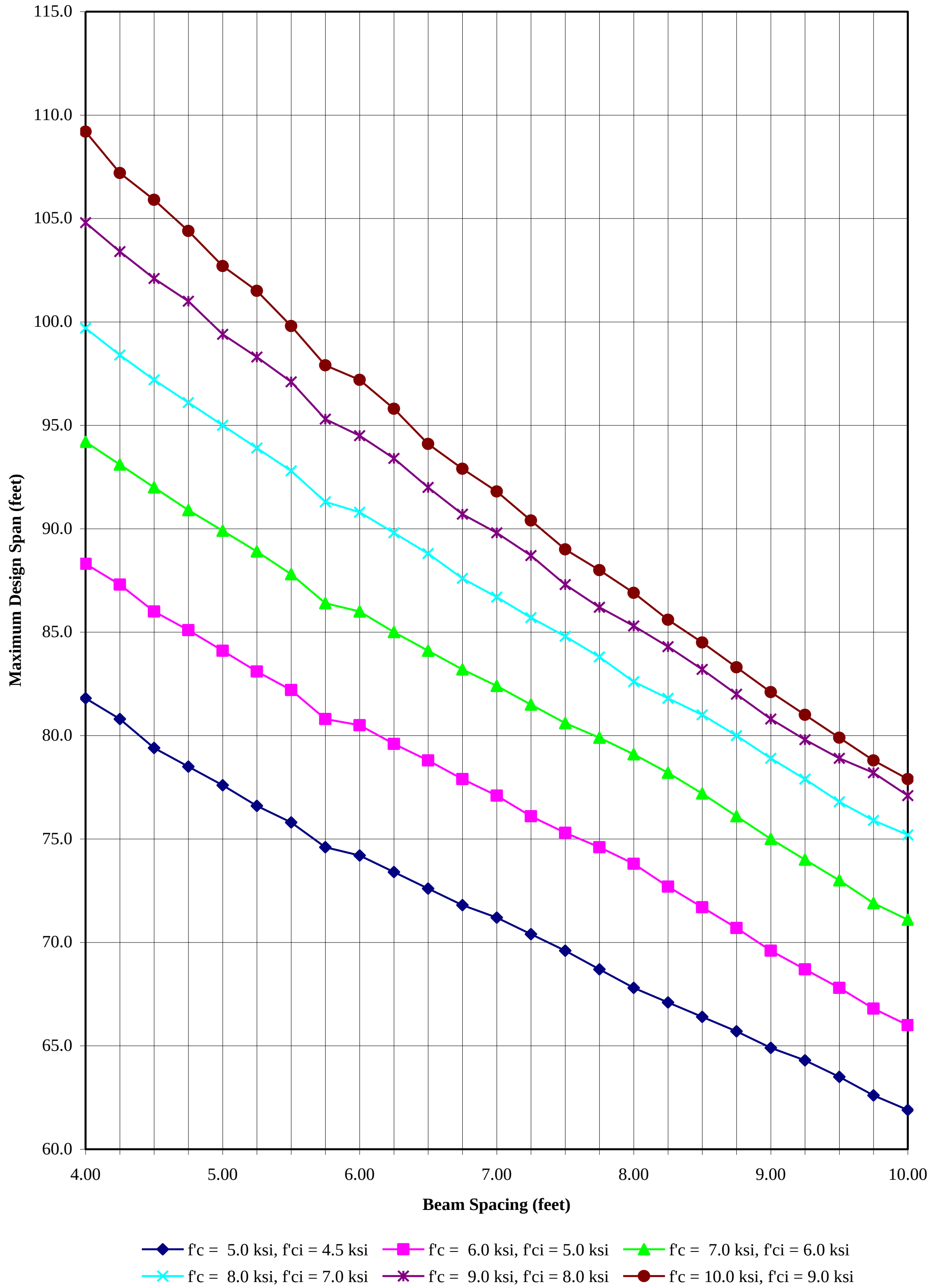


Figure 3-6

All strands are ½“ diameter low relaxation strands each stressed to 33,818 pounds.

Type IV PSC Beam

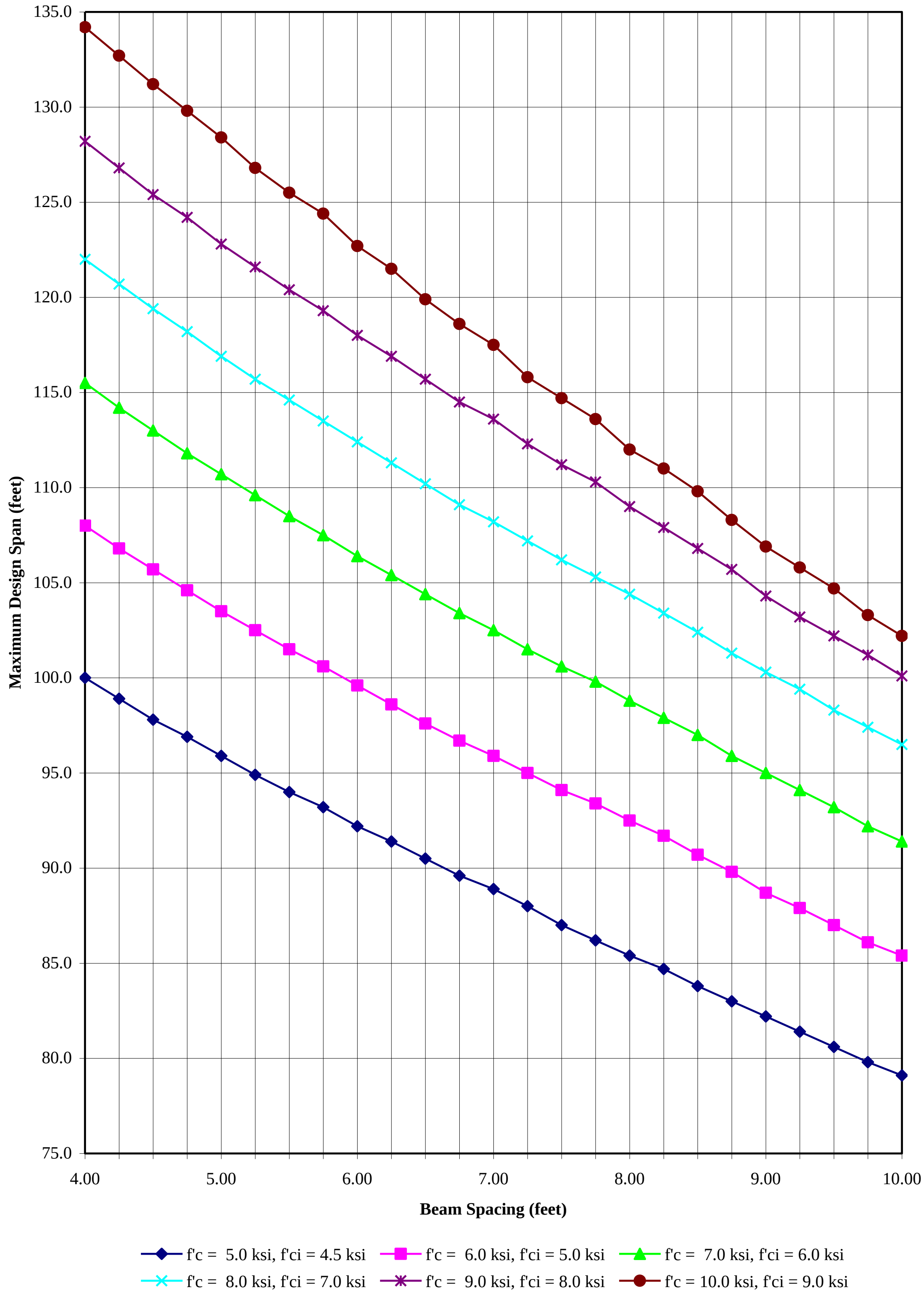


Figure 3-7

All strands are ½" diameter low relaxation strands each stressed to 33,818 pounds.

54" Bulb Tee Beam

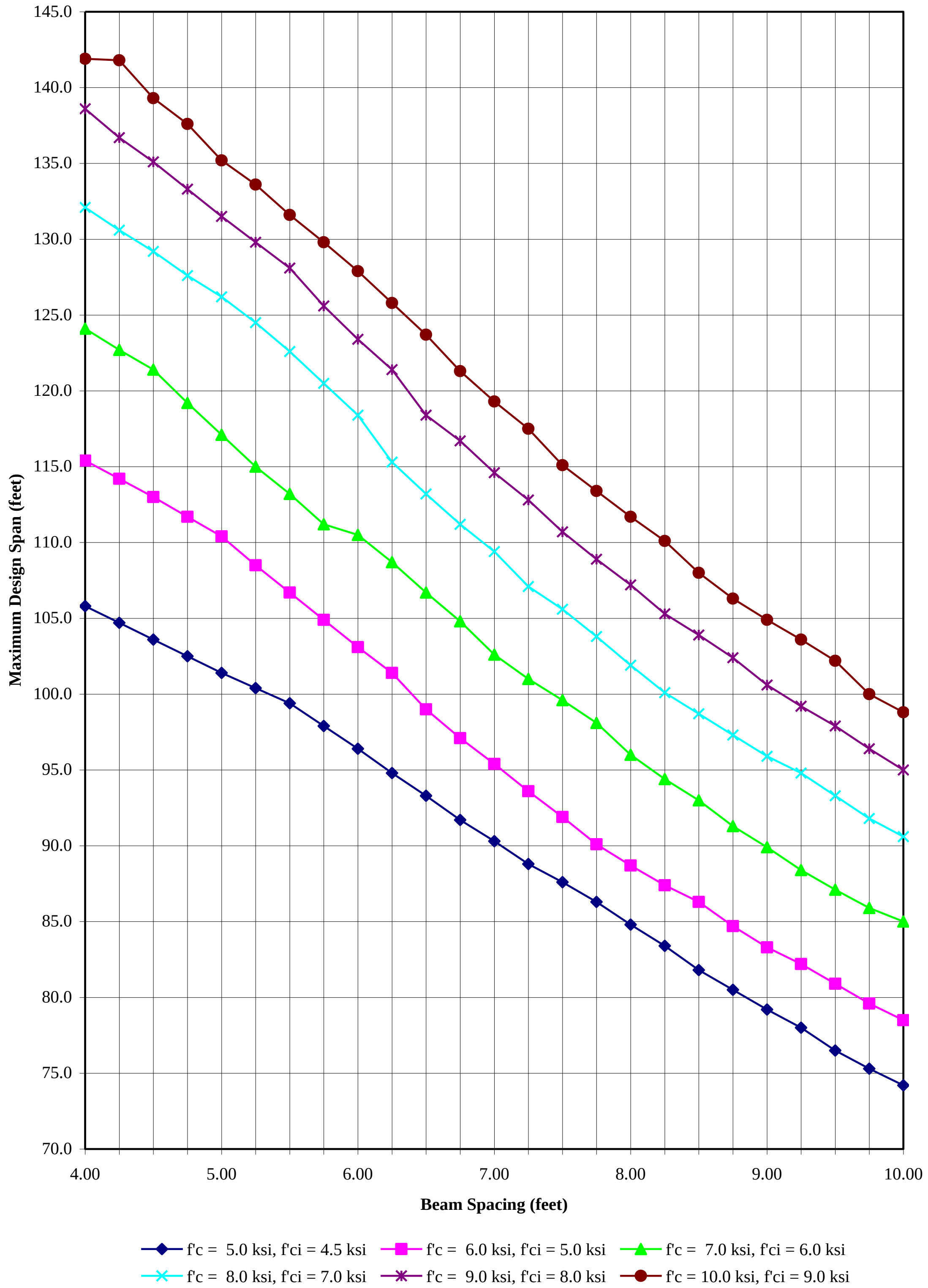


Figure 3-8

All strands are .6" diameter low relaxation strands. The 4 top flange strands are stressed to 10,000 pounds each and all remaining strands are stressed to 43,943 pounds each.

63” Bulb Tee Beam

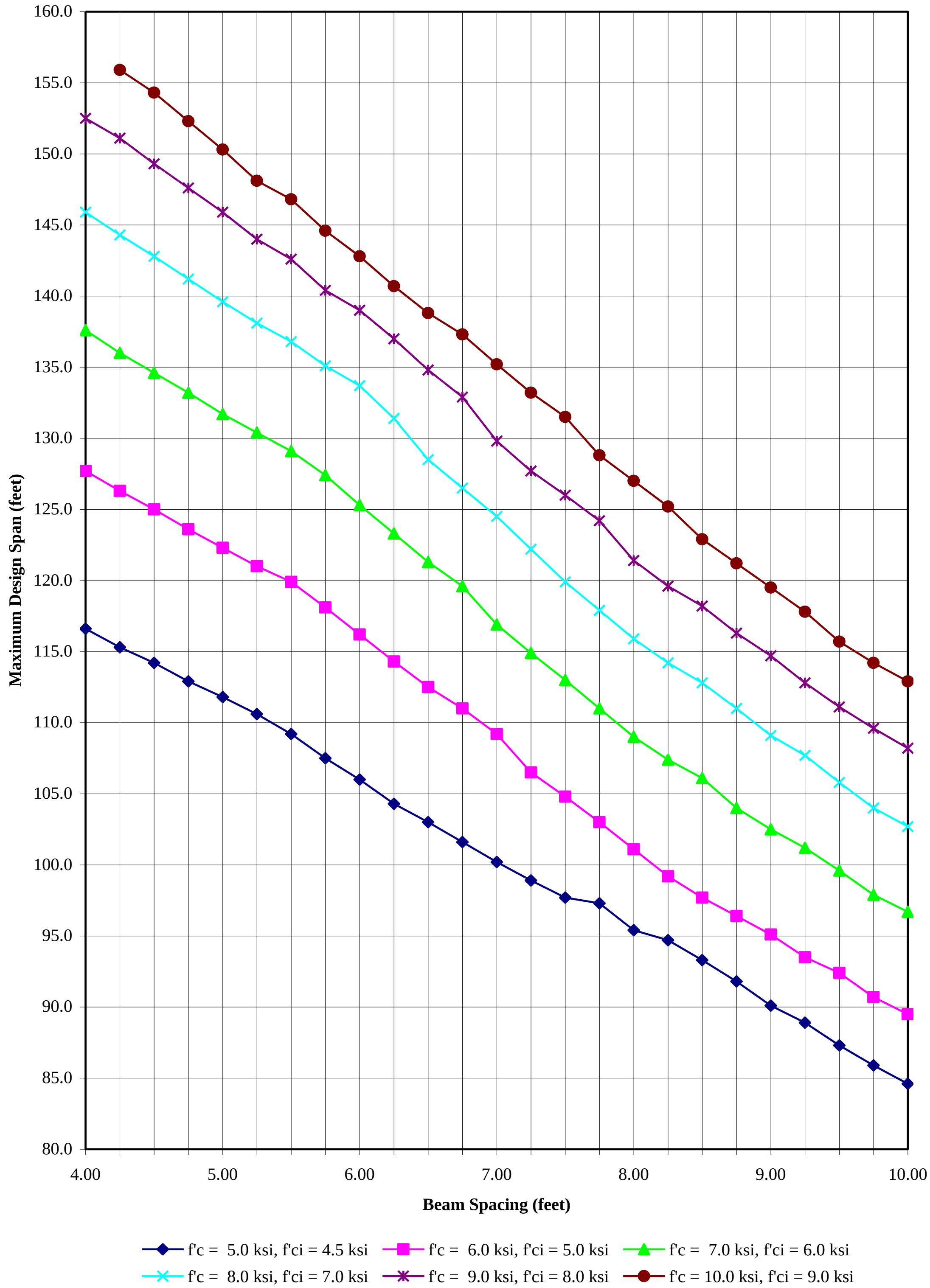


Figure 3-9

All strands are .6“ diameter low relaxation strands. The 4 top flange strands are stressed to 10,000 pounds each and all remaining strands are stressed to 43,943 pounds each.

72” Bulb Tee Beam

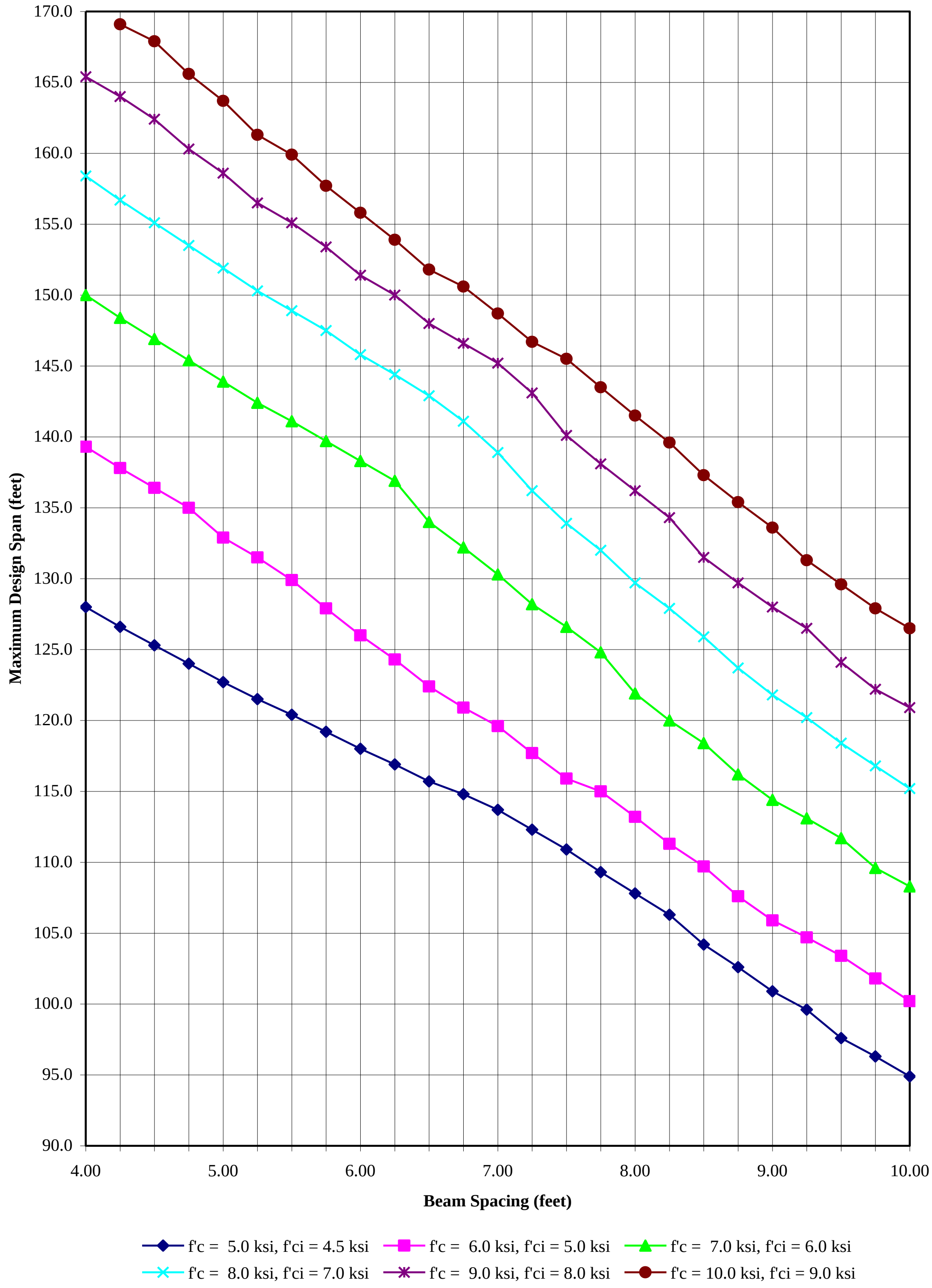


Figure 3-10

All strands are .6“ diameter low relaxation strands. The 4 top flange strands are stressed to 10,000 pounds each and all remaining strands are stressed to 43,943 pounds each.

74" Bulb Tee Beam

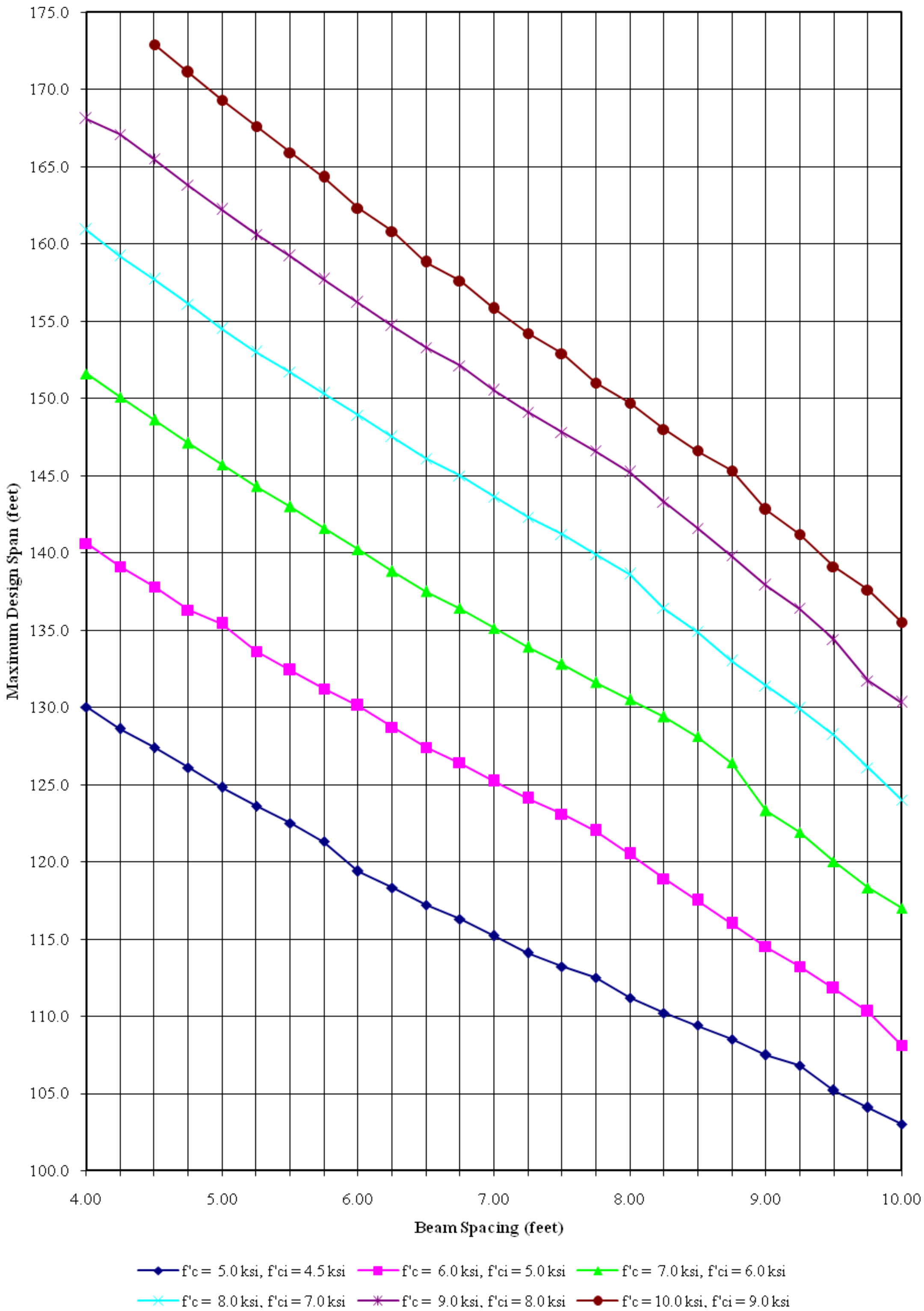


Figure 3-11

All strands are .6" diameter low relaxation strands. The 4 top flange strands are stressed to 10,000 pounds each and all remaining strands are stressed to 43,943 pounds each.

3.12.3 Prestressed Concrete Box Beams

At bridge sites involving the crossing of deep railroad cuts or streams of substantial width with shallow water (floating equipment not feasible), prestressed concrete boxes longer than 40 feet should not be used inasmuch as (1) site conditions would prohibit the placing of lifting equipment in the area below the bridge, and (2) it is not feasible to erect the boxes from the bridge deck.

If spans longer than 40 feet are to be erected from above, then the bridge must be designed to accommodate the construction procedure and the erection equipment rather than the design traffic load.

When designing using the 1'-5" x 4'-0" 2-cell prestressed box beam, the details shown in Fig. 3.12.5 shall be used as a guide in order to obtain a maximum consistency in detailing.

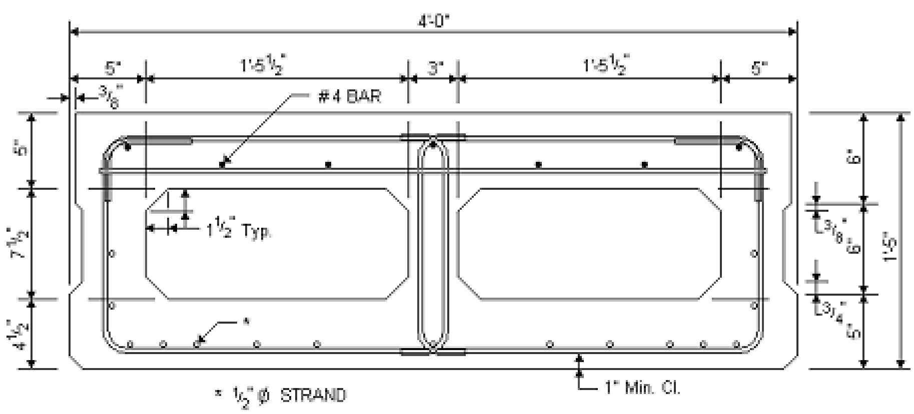


Figure 3-12 Prestressed box beam

3.12.4 Shipping Limitations

Based on readily available shipping equipment, there is a practical limit as to the length of beam that can be hauled. Project location, roadway access, and proximity to the fabrication yard all play a role in determining the length of girder that can be hauled to the site. The weight of the girder and how that weight is distributed on the transport equipment must also be considered.

The designer shall seek prior approval of the feasibility of shipping and delivery of long and/or heavy beams in accordance with section 1.4.8.

3.12.5 Detailing

On the beam sheet, do not include the diaphragm weight in the non-composite deflection since that deflection will have already occurred prior to pouring the deck. Also, do not include deflection due to future paving in the composite dead-load deflection since it might never occur. For losses, use the information shown on page 4 of the beam output. Make sure that the total jacking is the actual sum of the jacking per strand that you specified on the sheets.

Detail expansion slot at 1.5" X 6” long X 7" deep in Bulb Tee beams. Don't forget that if strands are not draped or they are draped low that strands in the web can conflict with the sleeve. Therefore, leave undraped strands out of the web area in at least the bottom 3 rows of strands to avoid conflict with the chase.

If the web is crowded with strands, make sure they are not in conflict with the diaphragm holes, especially with the 5-inch diameter blockout for the nut and washer.

Diaphragm bars - Detail all block-outs for diaphragm bar nuts and washers as shown on the Bridge Office standard sheet. Diaphragm bars shall be located to avoid interference with draped strands and utilities.

Skewed ends - Girders on skewed bridges shall have only the top flange skewed. See the PSC Beam detail sheets.

Cracking at girder ends - Provide the minimum amount of reinforcement at girder ends as required by AASHTO Article 9.22.

Detail girders to 1/16” increments and state on the Plans that lengths given are horizontal dimensions for in-place girders and that the fabricator shall adjust those lengths for grade and fabrication effects, such as shrinkage and elastic shortening. The dimensions from centerline bent or BFPR to centerline of bearing should be calculated, then subtracted from the span length along that beam to get the bearing-to-bearing length. The lengths from centerlines of bearing to the ends of the beam should be added to this to get the beam length. If the beam length contains a sixteenth of an inch, the half-length shown should be rounded to a sixteenth or an eighth. This will provide for the most accurate dimension for the beam length and for the bearing-to-bearing length.

The Designer should consider the fabrication tolerances for prestressed beams when positioning the bearing area so that the unreinforced areas at the ends of the beams are not put in bearing.

Due to problems with exterior beams rotating during deck pours, the following note shall be placed on the deck section sheet for bridges with Type I, Type I Mod, or Fascia beams where no diaphragms are present:

> *The Contractor shall provide bracing between the exterior beam and the first interior beam until the deck has been poured and the overhang forms removed. All costs for designing, providing, installing and removing bracing shall be included in price bid for Lump – Superstructure Concrete.*

When detailing prestressed concrete beams, provide a minimum of 2" for AASHTO beams and 2” for Bulb-T beams from the end of the beam to the edge of the bearing pad. There is a 3/4" chamfer at the end of the beam and a 3/4" tolerance on the length of the beam. A distance less than 2" to the edge of the bearing pad leaves no room for error in construction.

3.12.5.1 Coping and “D” Dimension

Use a 3/4 inch minimum coping on shorter AASHTO Type I-III PSC beams and 1½ inches on longer beams (including all Bulb Tee beams).

Added to this will be additional amounts for cross-slope, beam throw, camber, and vertical curve. In crest curves the vertical curve amount will reduce the D dimension. In sharp crests, the vertical curve can negate the camber entirely meaning the minimum coping would occur at the ends of the beam. To calculate camber, take the value of camber from the prestressed beam program output and reduce its magnitude by the values for deflections due to non-composite dead load, p-loads, and the non future paving portion of the composite dead load (typically barriers, sidewalks, and utilities).

The “D” dimension should be shown to the nearest 1/8 inch and calculated separately for exterior and interior beams as well as each span. Group “D” dimensions that don't calculate out exactly the same but be aware that on wide-flanged PSC beams this can add up to a lot of concrete, especially if only one span controls on a long bridge.

3.13 Steel Beams

3.13.1 General

The use of structural steel for bridges is generally not preferred due to the high cost of fabrication and long-term maintenance in comparison to concrete bridges of similar span lengths. However, the presence of long span lengths or widening of existing bridges may warrant the use of structural steel, but before proceeding with any design, the use of this material shall be approved by the State Bridge Engineer, especially when the project is located in any of the Coastal counties as follows: Chatham, Bryan, Liberty, McIntosh, Glynn and Camden.

The use of cover plated members is prohibited. When widening a bridge “in kind” that has cover plated members, the use of a larger member is suggested.

3.13.2 Materials

Structural Steel:

Main Members: ASTM A709, GR 50 (Fy=50,000 psi)
Other: ASTM A709, GR 36 (Fy=36,000 psi)

The designer shall seek approval of the use of Grade 70 High Performance Steel (HPS) from the State Bridge Engineer prior to proceeding with any design.

The use of Grade 100 or higher HPS is not authorized at this time.

The use of unpainted “weathering steel” on highway bridges is prohibited.

3.13.3 Design Method

It is preferred that the Load Factor Design Method is used for the design of Structural Steel Members. However, since the program BRSPAN designs only in ASD, it is acceptable to use ASD for simple spans and when widening existing bridges “in-kind”.

The strength contribution of negative moment reinforcement in the slab is generally ignored.

3.13.4 Fatigue

This pertains to cases in which ADTT of 2500 or more requires over 2,000,000 cycles for truck loading fatigue design from the AASHTO Specifications.

In general it will be the policy of the Office of Bridge and Structural Design to design bridges and structures for a total life of 60 years. Since traffic growth is nearly linear with respect to time, the average daily truck traffic, ADTT, will occur when the bridge is 30 years old. Also since the percentage of trucks remains almost constant with time, the ADTT can be obtained by direct ratio using percent trucks and the traffic volumes for the present and the future 20 years. The following example will show the procedure is to be used.

GIVEN: Type of road - Major Highway
ADT (2001) = 1000
ADT (2021) = 80000
T (trucks) = 4.4%

FIND: ADTT to be used for fatigue design life of 60 years

SOLUTION: ADTT will occur when the bridge is 30 years old.

ADT (2031) = 30/20 x [ADT(2021) - ADT(2001)] + ADT(2001)
= 1.5 x [80000 - 1000] + 1000
ADT (2031) = 119,500

Number of vehicles per day in one direction = ADT(2031) x 1/2 = 59750

Therefore, ADTT = % Trucks x Number of vehicles per day in one direction

ADTT = (4.4/100) x 59750 = 2629 in one direction only.

Since 2629 > 2500, the truck loading fatigue design shall be based on 2,000,000 cycles with all lanes of traffic on the bridge. Therefore a distribution factor of S/5.5 will be used to design the beam for maximum stress and to check the actual stress range, F_{sr}, in the AASHTO Specifications. Then the bridge shall be loaded with only one truck. A distribution factor of S/7.0 shall be used to obtain the actual stress range, F_{sr}. The actual stress range, F_{sr}, due to one truck is used to check against the allowable range of stress, F_{sr}, in the AASHTO Specifications for over 2,000,000 cycles.

3.13.5 Details

3.13.5.1 Plate Sizing

Flanges:

Minimum Plate thickness: 3/4”
Maximum Plate thickness: 2” (Thicknesses up to 4” may be used with approval from State Bridge Engineer)

Minimum Plate width: 12”
Maximum Plate width: 36”

Changes to flange widths and thicknesses drive up the cost of structural steel due to the high cost of labor involved. For this reason, designers shall strive to reduce the number of changes to the flange sizes along a beam – a practical minimum length of flange plate should be about 12’. Forces flow better through changes to thicknesses than changes in width, therefore it is recommended that, where practical, make changes only to flange thicknesses. However, it is also recommended to limit the change in flange thickness to 1.5 times the thinner plate size. Due to welding and fatigue considerations, the designer shall strive (by reducing beam spacing, using wider flange plates, etc.) to keep the tension flange plates from becoming too thick - a maximum of 2” is suggested.

Webs:

Minimum Plate thickness: 3/8”
Maximum Plate thickness: 1 1/4”

Minimum Plate width: 36”
No maximum (but 120” may be a practical limit)

Changes to web thicknesses are very costly and therefore discouraged. Use the same web thickness throughout the bridge. For web depths 72” and less, an un-stiffened web is usually more economical than stiffened webs. Above 72” transversely stiffened webs may be more economical, but only if there is a limited number of stiffeners. Use of Longitudinal stiffeners is prohibited.

3.13.5.2 D dimension

The minimum D dimension for Steel Beams shall be 3/8” + the thickness of the top flange.

3.13.5.3 Members Subject to Tensile Stresses

Steel beam or girder superstructure bridges shall carry the following note:

.... are main load carrying members subject to tensile stress and shall meet the Charpy V-notch test requirements as specified by Section 851 of the Georgia DOT Specifications.

The beam details sheets should also have a symbol (CVN) indicating which components require Charpy testing.

A guide as to what constitutes these components is as follows:

Simple spans:
W beam section – W beams
Girders – Bottom flanges

Continuous units:
W beam sections – W beams
Girders – Top and bottom Tension flanges

3.13.5.4 Shear Connectors

Shear connectors shall be 3/4” diameter end welded studs. The height of the studs depends on concrete haunch dimensions. Shear connectors shall penetrate at least 2” above the bottom of slab, but the top of the stud head shall be 3” below the top of the deck slab. Use of the same height stud throughout the bridge is preferred. Shear studs shall not be located on tension flanges.

When replacing the deck on existing steel beams that are noncomposite, add stud shear connectors in pairs 18 inches apart in the positive moment regions of continuous beams and throughout simple span beam.

3.13.5.5 Stiffeners

All stiffeners are welded to the web. Bearing stiffeners are tight fit at the top and bottom. Gusset plates for diaphragms are welded to the top and bottom flange in addition to being welded to the web.

3.13.5.6 Beam Camber

Camber diagrams are only required for continuous spans. When necessary, camber diagrams should include the following note:

Camber ordinate shown includes dead load deflection due to the beam, slab, coping, railing, sidewalk and median, and includes the vertical curve ordinate.

There is a general note for rolled beams that states that rolled beams shall be placed with the cambered side up.

3.13.5.7 Splices

On long-span bridges, the designer shall consider how the beams will be transported to the project site. The maximum length of beam that may be transported on state routes is limited to about 170 ft. The maximum legal load is 180,000 lbs. (including 45,000 lbs. for the truck, see section 1.4.9). Therefore most long-span bridges will utilize field splices.

All field splices shall be welded with full-penetration butt welds. The use of bolted splices is discouraged, except for box girders.

Field splices shall be located at, or near, dead-load points of contra-flexure.

All built-up girders, regardless of size, shall be designed with stiffeners adjacent to the splice point. In order to allow ample room for welding, grinding and testing, stiffeners adjacent to splices shall be located 12" from the splice. Studs near splices should be no nearer than 12" to the splice.

3.13.5.8 Fascia Girders for Short End spans

For long interior spans used together with short end spans, the common practice has been to use full-depth fascia girders for the outside beams and minimum-depth rolled beams (without cover plates) for the interior beams. In these short end spans, the dead load deflections vary considerably, with the outside fascia beam having much less deflection than the interior rolled beams. Construction problems can ensue when the short spans are poured, especially when screeded with a transverse (Bidwell) screed. Thin cover on slab steel can occur if interior beams do not deflect as noted.

The Designer shall make every effort, commensurate with economy, to design these short end spans with equal depth beams or girders. In cases where it is felt that equal-depth girders are not feasible, the designer shall detail increased cover over the slab steel to insure that adequate cover is obtained.

3.13.5.9 Widening of existing bridges

The Office of Maintenance may request that, on widenings consisting of structural steel carrying members, any old extension tabs and/or back-up strips be removed. The designer shall insure that this work is included in the Plans.

3.13.6 Welding

Diaphragms or Cross Frames shall be welded before pouring the deck when the bridge skew is between 75 and 90 degrees.

Groove welding for gusset plate connections should be avoided because of the necessary back-up plates and special welding procedures. Instead, use a bent plate for the diaphragm or cross-frame attachment.

Because of the danger of cracks developing where backing strips are discontinuous at the root of the groove weld, the Designer shall note when checking the structural steel shop drawings that all backing strips shall be made continuous for the length of the weld. Also note that any joints in the backing strip shall be full penetration butt welds.

Because of serious cracking of web and flange sections of plate girders, which appear to propagate from the location of intersecting welds, no intersecting welds will be allowed on structural steel Bridge Plans or Shop Drawings. Base Metal in the area of intersection areas of welds shall be coped 4 times the thickness of the web or 2 inches.

Electro-slag weldments will not be permitted on bridge members.

When design for fatigue, all welds shall be Category C or better as defined by AASHTO specifications.

3.13.7 Paint

All new structural steel shall be painted with System VII regardless of the bridge location in the state. Existing structural steel outside the non-attainment areas shall be painted with System VII. Existing structural steel inside non-attainment areas shall be painted with System VI. For painting of H-piles, see Section 4.3.3.3.

3.13.8 Salvage of Structural Steel

Structural steel from plate girders will not be salvaged.

When the Office of Maintenance recommends salvaging structural steel from a rolled beam continuous unit, they should also recommend how the unit should be cut up to insure maximum future usefulness. If this recommendation is not included, it should be requested by the designer (see section 1.4.8).

In cases where existing structural steel is to be removed and reused, the Designer shall place a note on the bridge plans stating that existing structural steel, removed and reused or merely remaining in place, which is disturbed or damaged in any way during construction, shall be straightened and/or repaired under the supervision of the Inspection Section of the Office of Materials and Research, and cleaned and repainted per the Specifications.

3.13.9 Beam Corrections

Structural steel fabricators occasionally mistakenly punch or burn holes at the wrong location in bridge members. The past practice has been to allow the fabricator to place the holes in the correct locations, leaving the misplaced holes open. However, now fabricators will be required to fill the misplaced holes with high-strength bolts (A-325 or A-325 weathering) tightened in accordance with the Specifications.

All corrective work to obtain acceptable tolerances relative to sweep, camber or damaged structural steel beams or girders utilizing heat procedures shall be documented and filed in the appropriate Project File.

All documentation relative to heat corrective procedures shall contain a sketch showing the location(s) where heat was applied, how much heat was applied and how long a period of time the heat was applied.

The amount of sweep, camber or damage shall be documented both before and after the heat corrective work. If possible, photographs of the beams or girders should be taken before and after all corrective work utilizing heat procedures.

3.14 Post-Tensioned Box Girders

Post-Tensioned Box Girders shall be designed in accordance with AASHTO Section 9 – Prestressed Concrete and the Guide Specifications for Design and Construction of Segmental Concrete Bridges 1999 and as noted herein.

3.14.1 Dimensions

The maximum cantilever overhang outside the outside web shall be limited to a maximum of 9’-6”. The design shall consider providing adequate vertical and horizontal clearance for required falsework for construction.

3.14.2 Materials

a) Concrete
Post-tensioned concrete boxes shall be specified for Class AA-1 concrete as a minimum, but may require higher 28-day strength.

b) Reinforcing Steel

Epoxy coated reinforcing steel shall be used in the top mat of the deck and in the traffic side of the barrier or parapet and endpost for concrete box girder bridges located north of the fall line. At these locations, superstructure bars on the traffic side of the bridge with less than 4” of cover should be epoxy coated.

3.14.3 Design of Post-Tensioned Prestressed Box Girder Bridges with Use of Permanent Precast Prestressed Concrete Panels in the Top Slab

The use of permanent (stay-in-place) concrete or steel deck forms or panels, for the top slab of the box girder, is not allowed.

3.14.4 Cell Drains

4” diameter cell drains shall be provided at the low point of all closed cell boxes.

3.14.5 Reinforcing Local to Post Tensioned Ducts

The requirements for clearances, duct spacing and duct support saddles shall be fully detailed on the bridge plans as shown in Section 508.1.03, Figures 1 & 3 of the GDOT Standard Specifications for Construction of Transportation Systems 2001 Edition.

3.14.6 Detailing of Anchorage Blisters

The requirements for dimensions, clearances, and reinforcing steel shall be fully detailed on the bridge plans as shown in Section 509.1.03, Figure 2 of the GDOT Standard Specifications for Construction of Transportation Systems 2001 Edition.

3.14.7 Open Grate Access Doors

Open grate access doors shall be used on concrete box girders carrying water mains. Every bay which has a water main should have this type access door at each end of the bridge so that if the water main leaks or breaks, the water will run out of the bay.

3.14.8 Gas Lines on Post-Tensioned Box Girders

The designer shall not detail gas lines inside the closed cell of box girders unless specifically instructed by the Bridge Engineers.

In this case, the Designer should be aware of the following criteria and should consider accommodating them in the Plans where applicable:

1. Increase the wall thickness of the present pipe being used on bridge structures.
2. All welded lines by certified welders.
3. Hydrostatically tested pipe.
4. Install a 6” vent in each end cell.
5. Install in each cell a test insert, malleable iron, with replaceable rubber insert.
6. Inspect each cell periodically with a gas leak detection device.
7. Inspect physically complete portion of pipe within bridge cells annually.
8. In the event a repair should be required, this could be done within any cell by using a mechanical clamp and weld-over (both in half sections and may be carried inside through either access door, etc.).
9. All lines shall be limited to low pressure.

3.14.9 Segmental Construction Alternate for PT Boxes

When a segmental construction alternate is to be allowed on post-tensioned box girder bridges, the following note shall be included in the Bridge Plans:

Segmental Construction – Proposals for construction by segmental methods may be submitted for consideration as an alternate to the method shown in the plans. All proposals shall include a set of construction drawings and complete design calculations. All proposals shall conform to the latest AASHTO Specifications including the Guide Specifications for Design and Construction of Segmental Concrete Bridges and no tension stress in the concrete after losses shall be allowed. All proposals shall also conform to the Georgia DOT Specifications and will be subject to approval by the State Bridge Engineer. If approved for use, the alternate segmental construction methods shall be at no extra cost to the Department and with no increase in contract time.

4 Substructure

The following Section addresses GDOT policy concerning the substructure for typical highway bridges.

4.1 Foundations

Substructure for bridges shall be designed based on the Engineer's utilization of the Bridge Foundation Investigation (BFI) approved by the Office of Materials Research (OMR). Substructures shall be designed for existing conditions. When piles are used, they should have a minimum of 10 feet of penetration below the 500-year scour line. Spread footings should be keyed in below the 500-year scour line. The 500-year scour line will be shown on the Preliminary Layout and may be adjusted in the BFI. Scour information shall not be included in the final bridge plans. Deep foundations shall be designed for a Safety Factor =1 for the 500 year storm event.

The foundations for highway bridges consist of the various elements necessary to support the superstructure. These may include:

- Piling for deep foundations
- Caissons
- Spread footings
- Pile footings
- Cofferdams & Seal Concrete

4.1.1 Piling

The Department uses the following pile types:

- Prestressed Concrete Piling (PSC)
- Metal Shell Piling
- Steel "H" Piling

For general guidelines for foundation type in Georgia, see Fig. 4.1.1.1.

Total pay quantity for piling is rounded off to the nearest 10 feet. The anticipated length of each pile is the elevation of the top of pile minus the elevation of estimated tip (or the average estimated tip if a range is given). The Engineer shall include the additional length of piling caused by battering piling.

Battered piles, where required, are typically battered at a rate of 1½ inches horizontal on 12 inches vertical. In no case shall the batter exceed 4:12.

When the BFI recommends PSC piles, they also usually recommend locations for test piles. The contractor uses test piles to come up with final order lengths of the remaining piles, therefore test piles are longer than in-place piling. Test pile lengths shall be calculated as follows: The length of each test pile equals 5 feet plus the top of pile elevation minus the estimated tip elevation. Round test pile lengths up to the nearest foot. Because test piles are part of permanent construction, the engineer must deduct the calculated in-place length (not the test pile length) from the total piling quantity.

In addition to the pay items for the size of piling required and the type and size of test piles, always include a pay item for a load test for every type and size of pile used on the project.

The following figure is provided to the designer as a guide for the anticipated bridge foundation type by region.

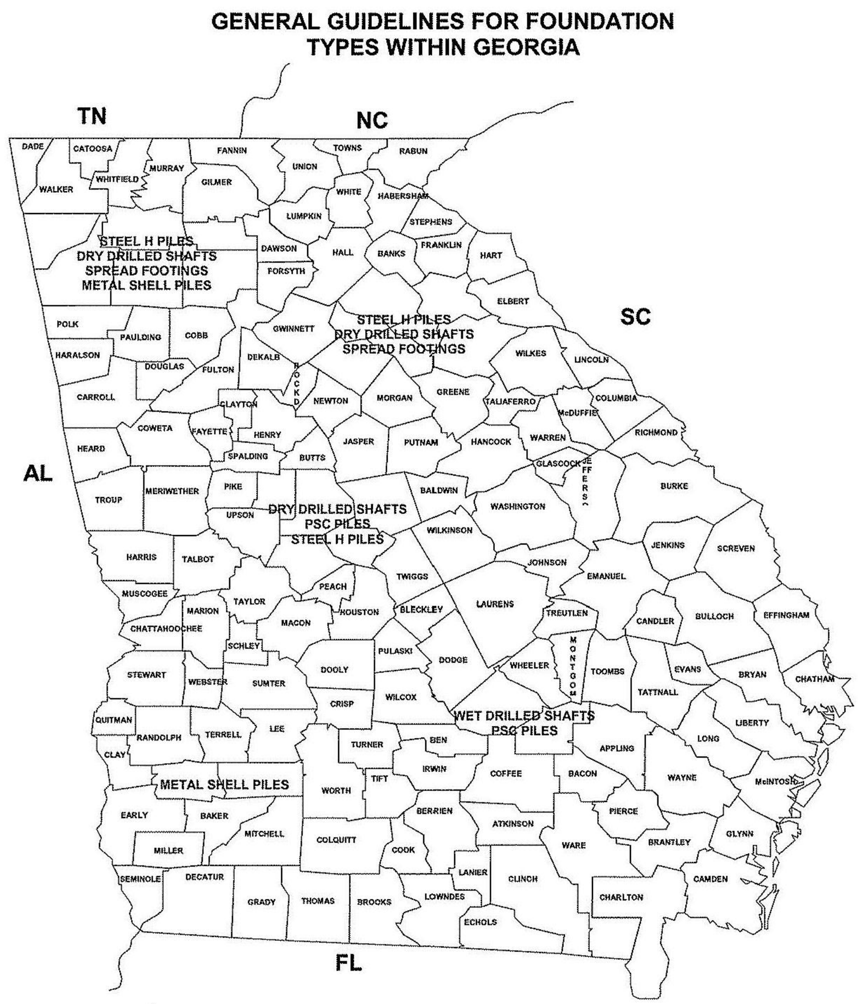


Figure 4-1 Rough guide to foundation types

4.1.1.1 H Piles

Steel H Piling specified for use in the Bridge Foundation Investigation will be one or several of the following sizes:

HP 10x42   HP 12x53   HP 14x73   HP 14x89   HP 14x102   HP 14x117

Unusual circumstances might require a pile size greater than these listed. The Engineer shall contact the Bridge Office for approval prior to utilizing a pile size not listed above. Capacities for H-piles larger than HP 14x89 are generally not included in the BFI, but can be added by request. Though a larger pile hammer may be required to achieve higher capacities, this may still be more economical than, for instance, driving two smaller piles per beam in an end bent.

Though Grade 50 piles are available, use 36 ksi in design. Use 50 ksi only with permission of Bridge Design.

4.1.1.2 PSC Piles

Prestressed Concrete Piling (PSC) when specified for use in the Bridge Foundation Investigation (BFI) shall be of the following size: 14”, 16”, 18”, 20”, 24”, 30”, and/or 36”.

The Engineer shall contact the Bridge Office for approval prior to using a PSC pile size greater than 20”.

Should severe corrosion or other unusual problems make Type II cement or HPC (High Performance Concrete) necessary as recommended by the Office of Materials and Research, it shall be so noted on the Plans.

In the General Notes sheet under Bridge Consists Of, add
SQUARE PRESTRESSED CONCRETE PILES -------------- GA. STD. 3215 (2-22-84)

4.1.1.3 Metal Shell Piles

Metal Shell Piling (MS) shall be specified for use in the Bridge Foundation Investigation (BFI) and will generally be chosen from the following list:

12 ¾” O.D.   14” O.D.   16” O.D.   18” O.D.   24” O.D.

Metal shell piles in a pile bent are assumed to have no strength other than the reinforced concrete poured inside. Shell piles in an end bent or pile footing are not filled with concrete.

4.1.1.4 Timber Piles

Timber piles shall not be used on any GDOT bridge project. They are sometimes used to support culverts in poor soils.

4.1.1.5 Jetting, Spudding, Predrilling & Pilot Holes

The BFI often recommends jetting and/or spudding to assist in obtaining penetration for PSC or MS piles. Jetting consists of using water at the tip of the pile to loosen the soil and aid driving. Spudding consists of using a "spud" (usually a heavy H-pile) to break up hard layers before driving the permanent pile. The General Notes in BRNOTES pertaining to jetting and/or spudding of piles should be included in the plans only when it is recommended in the BFI. On some occasion, the BFI will recommend that predrilling be allowed at the contractor's option. When the BFI mentions predrilling, the Jetting and Spudding note should be modified by adding the following:

At contractor's option, use predrilling in lieu of jetting or spudding. The extent of predrilling shall be to elevation ___.__. See Section 520 of the Georgia DOT Specifications.

The BFI will make a recommendation for the elevation, perhaps as a reference to the estimated or minimum tip elevations. No pay item is needed for predrilling, which consists of auguring the soil, but not removing it.

The BFI sometimes recommends pilot holes for piles in order to assure adequate penetration below the scour line. Pilot holes consist of using an auger to drill a hole and remove the soil which is a more costly process than predrilling. When this is the case, include the pilot hole General Note and the pilot hole pay item in the plans to cover the required quantity of pilot holes. The pilot hole General Note should specify the required diameter and the bottom elevation of the pilot hole.

4.1.2 Caissons

Caisson sizes and capacities are specified in the BFI and are covered under special provision, usually part of the BFI. Some of the different variables of SP 524 include whether the hole is dry or uses slurry, and whether a demonstration shaft is required. A minimum caisson size of 48 inches is required to allow inspectors access (for dry caissons). A caisson with a diameter 6 inches larger than a column works well because the main reinforcement will line up given the different clearances for each type of structure, however never use a larger caisson than needed. Reinforcement in the caisson is specified by size only (#10 instead of 1010) because payment for it is included in linear feet of caisson. However when using a transition bar that laps with the steel in the caisson and the steel in the column, that steel can be detailed and included in the bar schedule. Do not use hooked bars in the top of a caisson. For caissons in the water, set the top of the caisson above the normal pool elevation. For caissons in the ground, the top shall be 1’ below final ground elevation.

4.1.3 Spread Footings

Spread footings shall be a minimum of 2’-3” thick with 2’ minimum cover over the footing. Spread footings are generally square.

When recommended in the BFI, spread footings and the seals beneath spread footings should be keyed into the underlying material. The entire footing or seal should be keyed in, not just the area under the column as indicated in the Standard Specifications. This requires a note on the Plans.

Intermediate bents utilizing spread footings shall be designed to allow the spread footing to be lowered a minimum of 3 feet from bottom of footing elevation recommendations in the BFI.

When the BFI or Construction Office recommends setting up Type II backfill material under a footing, do not increase the bridge excavation for this material since the spec covers additional excavation up to three feet below the plan elevation of the bottom of footing.

4.1.4 Pile Footings

Pile Footings are used with concrete intermediate bents as directed by the BFI, typically when there is insufficient bearing capacity in the shallow sub-surface strata. The top of the Pile footings for railroad and grade separations are ALWAYS located a minimum of 2 feet below ground. Pile footings for stream crossings are a bit more complicated. In general, the top of the pile footings for stream crossings will be located the same as for grade separation, EXCEPT with the following exceptions:

1. If the bridge is located in one of the coastal counties and the waterway has very low flow velocity and debris potential (such as in a coastal swamp), then the bottom of the footing will be located 1 foot above mean water level. This is known as a "pedestal bent".

2. Or a bridge in any area that has a large number of pile footing bents that require cofferdams. The excessive cost of the cofferdams may make the pedestal bents a viable alternative. However, use of this option must be approved by Bridge Design

Provide 180° hooks on the bottom mat of reinforcement in pile footings. The bottom mat of reinforcement is allowed to be placed directly on top of H-Piles. However, the Engineer shall provide 3 inches of clearance on top of metal shell and PSC piles to allow the footing concrete to properly bond with the footing reinforcement.

Pile footings shall be designed for zero tension (no uplift) in the piling. In BRPIER, start with a square footing. When using a square footing, use the same reinforcement in both the transverse and longitudinal directions to avoid incorrect installations in the field.

4.1.5 Cofferdams/ Seals

Not all bridge projects need a recommendation for cofferdams and/or seals for intermediate bent construction. Bridges that do not need a recommendation are ones that are on pile bents or caissons only, one-span bridges, and bridges that do not have cast-in-place concrete footings close to the water table.

Determination of the need for cofferdams and/or seals is a responsibility of the Office of Construction. For bridges with concrete bents at a stream crossing, a copy of the BFI Report (preferably one that is approved, depending on schedule), elevation of 2-year highwater, and a half-size of the bridge Plan and Elevation sheet (not the preliminary layout as it does not show bottom of footing elevations) shall be transmitted to the Assistant State Construction Engineer – Bridges for a recommendation. This recommendation shall be the basis for plan data. Seals should not be used except as recommended by the Office of Construction due to the possibility of future voids under the seal. Contractors should not be allowed to substitute a concrete seal in lieu of dewatering cofferdams.

Seals are typically 1'-6" wider than the footprint of the footing with a minimum thickness that creates a resisting force greater than the buoyant force caused by the hydraulic head of the water (H) on the other side of the cofferdam. These values have been standardized as follows:

Thickness of seal concrete (absolute minimum is 2 feet)

Pile Footings: 0.25 x 'H'
Spread Footings: 0.4 x 'H'

Use 2000 psi for seal concrete strength

The Plan and Elevation sheet should show the elevation of the bottom of the seal for spread footings, but the bottom of the footing for pile footings. The water elevation used to determine the footing height should be called out on the intermediate bent sheet.

Once a response is received from the Office of Construction, include a copy with the bridge plans submittal when plans are requested for review by the Office of Bridge Design. This submittal shall also include the following:

- copies of Bridge Maintenance's salvage recommendation
- copy of Bridge Maintenance's response for using oversized beams (if required)
- a Bridge Condition Survey report from Bridge Maintenance
- a Bridge Deck Condition report from OMR (for bridges that are being widened and/or jacked)
- a Bridge Foundation Investigation (BFI) report

Because the seal concrete price is based on the cost of Class A concrete when it is required but not set up in the plans, if your bridge does not use Class A concrete in the substructure and you are calling for cofferdams with no seals, a special provision is required for seal concrete.

4.2 End Bents

4.2.1 General

- Use Grade 60 steel
- Follow AASHTO specifications for reinforcement
- The length of detailed reinforcing bars should not exceed 60 feet.
- Concrete strength matches intermediate bents (one span bridges use 3000 psi)
- Do not use different concrete strengths in different parts of the substructure

End bent piles should support all loads including loads from the approach slab. For a typical 30-foot approach slab, consider the approach slab partially supported on soil and partially supported by the paving rest at the end bent. For a worst case, consider the length supported by the paving rest to be 10-feet. The Engineer shall consider the dead and live load on that 10 feet in the design of the end bent.

Use battered piles between beams in the end bent if the fill is greater than 20 feet. Use battered piles at the rate of 1 per 4 or 5 plumb piles. If the pile spacing is very close, some of the load-bearing plumb piles can be battered instead of adding piles.

A note shall be added to all end bent sheets that references Georgia Standard 9037 for drainage details required at end bents. The note shall read as follows: “SEE GA. STD. 9037 FOR DRAINAGE DETAILS AT END BENTS.”

4.2.2 End Bent Caps

The end bent cap width is usually 3 feet. However 2’-6” has been used on unskewed t-beam bridges and wider caps have been used when required by a very severe skew. Cap steps lengths do not need to match the calculated skewed beam distance. Instead, use even 1” increments. The concrete strength used shall be dictated by the strength used at the intermediate bents.

Form bearing holes of 3-inch diameter 12 inches deep (this will be deeper for steel spans longer than ~100 feet). For t-beams use a No. 10 dowel bar formed in place.

The designer should recognize the difficulty in forming up adjacent cap steps that are less than 1/2 inch different in elevation. If the difference is less than that amount match the lower elevation. The difference will be taken up in the coping though you do not need to detail this.

Cap steps can sometimes rise above the main reinforcement due to a crown, different beam sizes, or severe cross-slopes. A general rule would be if there are more than six inches of unreinforced concrete above the steel that you need to put No. 4 reinforcement in closer to top of the cap. Put stirrups in at roughly one foot spacing, making sure the legs of the stirrups extend down into the main cage at least one foot.

On a skew of 50 degrees or sharper be aware that a moveable (expansion) endwall may bind against the sides of cap steps. In particular, for fascia beams, the Engineer should consider skewing the cap step parallel to the beams to prevent the endwall from binding due to excessive skew. If the cap steps are small (<2 inches), an extra thickness of expansion material adjacent to cap steps can be used in lieu of skewing the cap steps.

4.2.3 Wingwalls

The length of the wingwall is calculated by extending the slope of the end roll up until it meets the grade elevation at the inside face of the wing (not the top of wing elevation!). When calculating the wingwall length, subtract out the two-foot berm in front of the cap and take into account the effect of the skew. The end of the wingwall does not need a pile if the length is less than 10 to 12 feet. Add an intermediate pile for lengths of 17 to 18 feet and greater. It is general practice to make the wingwalls the same length on each side of a bent. However, if the bent skew causes long wingwalls (in excess of 17 feet) reduce the length on the side not affected by skew. Typically, the top of wingwall is above the shoulder grade by 10 inches. Use 6 inches as a minimum to match the transition curb of the approach slab when present. Make the top of the wingwall level if the difference is less than 4 in. Otherwise, the top of wingwall follows the grade of the shoulder. On curved alignments, do not curve wingwalls. Use a skew angle for the wingwall that keeps the end of the wingwall from encroaching into the shoulder. The bottom of the wingwall is always level.

Increase the 2'-6" pile box to 3'-0" when using 18-inch or larger piles to provide additional clearance.

4.2.4 Rip Rap

At stream crossings, the endrolls are protected with Type I rip rap (larger than Type III) placed in a layer that is typically 24 inches thick (specified in the hydraulic study). Rip rap limits extend 20 feet beyond the end of the wingwall. The quantity for filter fabric equals the quantity of rip rap (yd^2).

When the Hydraulic Data indicates abnormal flows, the elevation for the top of rip rap shall be 2 feet above the abnormal 100-year flood elevation.

4.2.5 Slope Paving

Slope paving shall be used on all bridges crossing another roadway. The footprint of the slope paving extends beyond the edge of the deck by 2 feet on each side of the bridge. For skewed bridges, the slope paving parallels the edge of the bridge on one side and is normal to the bottom of the slope on the other side so that water will stay on concrete all the way to the bottom (see Figure 4-2). However, on railroads in cut sections limit the slope paving to 2 feet outside the edge of deck on both sides to minimize additional cut in the endroll (see Figure 4-3).

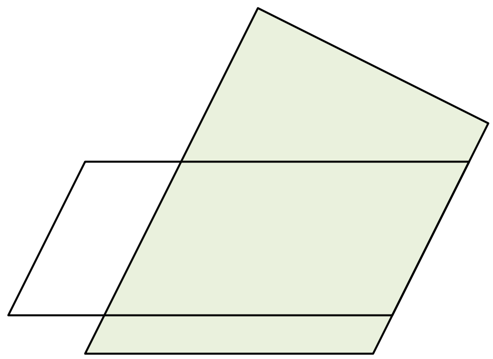


Figure 4-2 Typical slope paving at end of bridge

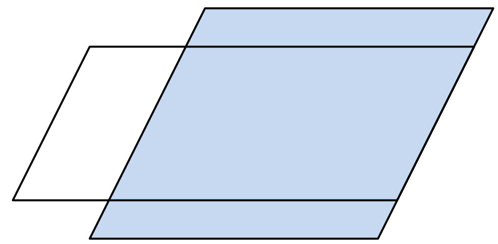


Figure 4-3 Slope paving at railroad cut section

4.3 Intermediate Bents

4.3.1 General

- Use Grade 60 steel
- Follow AASHTO specifications for reinforcement
- The length of detailed reinforcing bars should not exceed 60 feet.
- Use 3500 psi concrete in concrete piers (with cast-in-place footings and columns)
- Use 3000 psi concrete for pile bent caps unless there are also concrete piers present
- Do not use different concrete strengths in different parts of the substructure
- Use 2'-3" as minimum thickness of spread footings (to allow development of the 'J' bars)
- Seismic Design (see below)

The Category B counties of north Georgia are shown below (see map). Bridges in these Counties will require seismic analysis. A typical design, would use the analysis program SEISAB and then run North Carolina's version of BRPIER to consider the seismic forces. Seismic Category A is required everywhere else in the state. The Engineer is reminded that the bearing length requirements for Category A can be satisfied by the cap, not just the bearing pad itself.

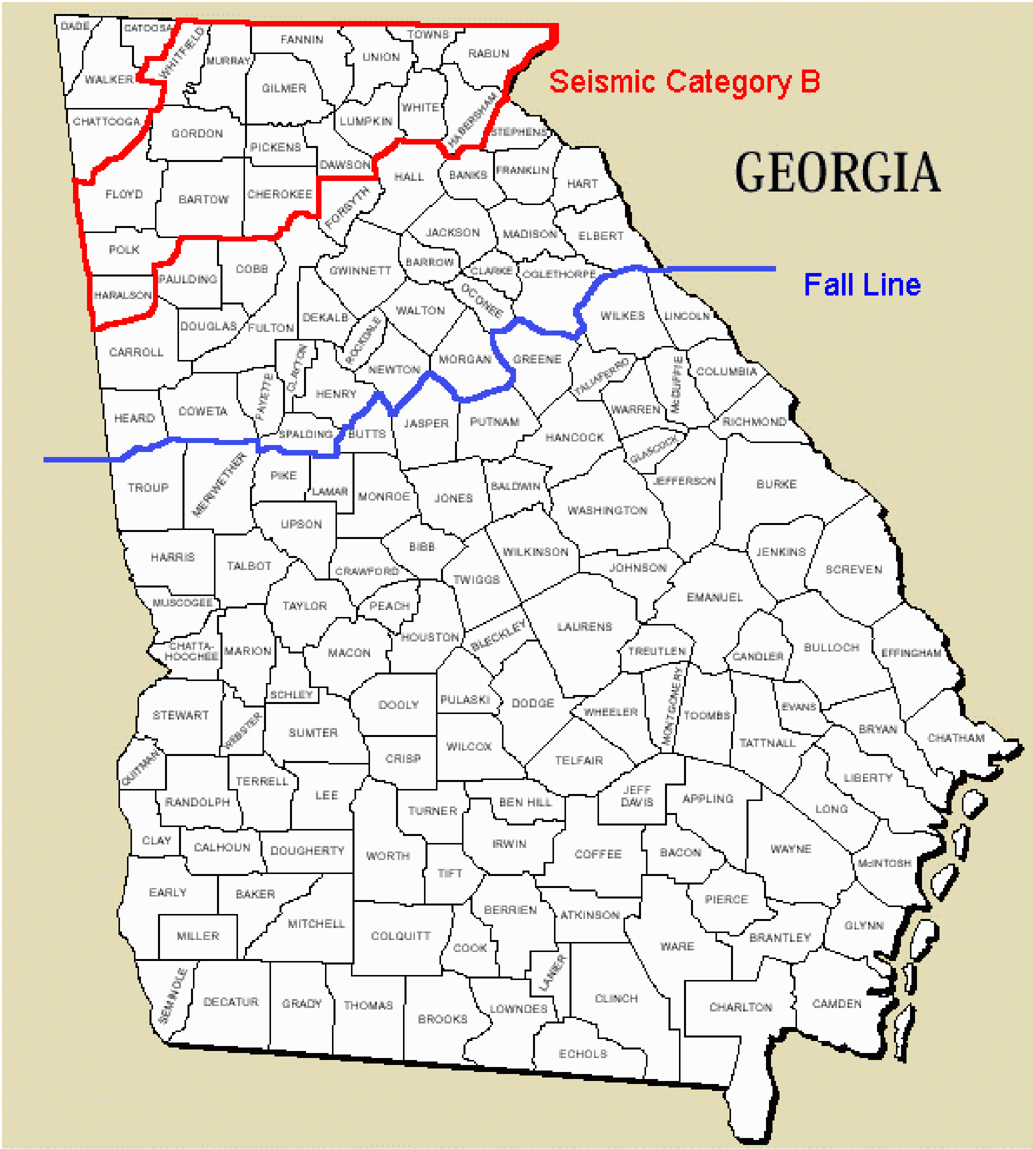


Figure 4-4 Map showing Fall Line and Seismic Category B

4.3.2 Concrete Bents

4.3.2.1 Intermediate Bent Caps

Caps for Intermediate Concrete Bents are generally 3 foot wide as a minimum. Widen cap in 6” increments to accommodate the width required to account for skew, bearing size and edge distances. Other cap dimensions may be in 3” increments.

The end of cap should extend out far enough that the bottom of beam crosses the front face or back face but not the end of the cap. If the beam crosses the end of the cap it may appear to the public that the beam is going to fall off of the cap.

Using 'open top' stirrups to miss anchor bolt hole block outs is permitted but usually not necessary. The contractor is able to shift stirrups in order to miss block outs for the anchor bolt holes, unless the cap stirrup spacing is very closely spaced (less than 5 inches). Use double stirrups to provide adequate spacing (>5inches) if necessary in high shear areas.

Size the pier cap to provide a minimum of 3 inches clearance from the edge of pad to the edge of the cap or edge of riser. On skews sharper than 75 degrees, this amount can be reduced to 2 inches since only the corner of the pad would be too close to an edge and the bulk of the pad would still be beyond the 3 inch limit.

When the back beams are deeper than the ahead beams, a riser will be required along the ahead side of the cap (or vice versa). In order to control cracking in this riser, make sure continuous lengths of rebar run the length of the riser (provide short segments under each cap step). Do not attempt to control cracking by putting in a joint down to the bulk of the cap between steps. This detail concentrates stresses at that point and can cause cracking in the main body of the cap. Another solution to this issue could be to transition the depth of the beams across several spans: for example, instead of tying 72-inch bulb tees to T-beam spans, a Type III transition span, would allow for incrementing the structure depth in shorter steps. The designer shall use this technique only with prior Bridge Office approval.

Cap steel can become very congested. Be sure to leave enough room to lap main reinforcement and still have clearance between bars. Watch the spacing on stirrups (which also lap at their corners). Though 3-inch spacing on stirrups is allowed, often it is a better solution to deepen the cap and increase the stirrup spacing. A practical minimum spacing would be 4 inches between double stirrups.

Design the main cap reinforcement for the moment requirements occurring at the quarter points of the column. Use the shear at the face of column to determine the required cap shear reinforcing steel.

Cantilevering caps for intermediate bents is expected. Avoid using 3 column bents unless necessary. Traditionally, two-column bents with caps that cantilever approximately 22% of the cap length will work up in caps up to 50 feet long. Beyond 50 feet, use two, 2-column bents or a 3 column bent.

4.3.2.2 Columns

When possible, limit the design to one column size per bridge.

Design columns to balance the dead loads on either side of the column to avoid long-term bowing due to creep. For a two column bent, a column spacing of approximately 56% of the overall cap length is a close approximation with which to begin the design process. For most bridges, set the column width equal to the cap width. Skewed bridges, however, tend to have wider caps to accommodate the bearings. It is acceptable and generally preferred to use a smaller column in such cases. To keep the cap and column in proper proportion, the minimum column width should equal or exceed 75% of the cap width. Columns should be dimensioned in 6 inch increments beginning at 3'-0". Columns smaller than 3'-0" should not be used except in cases where a smaller size matches the existing AND is necessary to maintain horizontal clearance. In general, columns should be square (unless matching a round drilled caisson) with a square reinforcing pattern (same number of bars in each face).

Detailing construction joints in columns requires judgment on the part of the Engineer. Use the following guidance in determining the number and location of required construction joints in columns:

For the following Column Heights (x):

		x	≤	30 ft.	No construction joint
30 ft.	<	x	≤	40 ft.	1 construction joint at mid-height
40 ft.	<	x	≤	60 ft.	2 construction joints at one-third points
60 ft.	<	x			Construction joints at 20 ft. max. spacing

Notes: Column height measured from top of footing to bottom of cap.
Reinforcement should be detailed to take the construction joint into account.

For drilled caissons, use a column size that is 6” smaller in diameter than the caisson to allow for construction misalignment.

In determining the concrete cover to the stirrup, check where the column main reinforcements are entering the cap. If the cap is the same width as the column, then the main column bars have to be shifted in to miss the main cap bars. This adds to the minimum concrete cover required. Do not hook column bars in the top of the cap.

Column ties shall be arranged to accommodate at least a 6-inch tremie to facilitate concrete placement.

The GDOT pier program methodology is not appropriate when designing short columns. The designer should adjust the minimum reinforcement to allow the program to reach a reasonable design. Long bent caps with short columns can create unexpected results from the program. In these cases, the concrete shrinkage factor can control the footing design (compare with a run with the shrinkage set to 0 to see what effect it is having). To keep that footing size down, the designer can make the columns longer by lowering the footing a couple of feet. Another alternative would be to set up construction joints in the cap with a waiting period to let some of the shrinkage occur. The Engineer is reminded that breaking the cap into pieces (two, 2-column bents) might use less piles and concrete than one 3-column bent. A wall or strip footing is a design option to replace a very short column bent. The minimum width of a wall pier is 2 feet. Consult the Bridge Office for approval prior to using a wall pier.

4.3.2.3 Footings

See Sections 4.1.3 and 4.1.4 for information about spread and pile footings.

4.3.3 Pile Bents

Pile bents consist of a concrete cap formed directly on top of piles. Piles to be used for pile bents are the same sizes as those allowed in H pile or PSC pile footings. The design shall place a pile under each beam.

4.3.3.1 Pile Bent Caps

Pile Bent caps are usually not designed for any calculated shear or moment and therefore are typically a minimum of 3' wide by 2' deep with nominal reinforcing. See bridge cells for a typical section. Cap steps lengths do not need to match the calculated skewed beam distance. Instead, use even 1" increments. The concrete strength used shall be dictated by the strength used at the intermediate bents.

4.3.3.2 Sway Bracing

Sway bracing is only used for H-Pile bents where the unbraced length of piling exceeds 12 feet. Sway bracing size is normally comprised of 4"x4"x3/8" angles arranged in an "X" fashion. Sway bracing for piles shall be detailed to extend 4 inches outside the edge of the exterior piles.

4.3.3.3 Pile Protection

Encase H-Piles in concrete in wet-dry environment as follows: in the stream, use encasement from 2 feet below ground to 2 feet above normal pool. On banks and flood plains, use encasement from 2 feet below ground to the highest of 2 feet above ground or 2 feet above normal pool (if unsure about the elevation of "normal pool", then extend the encasement to the 2-year flood height which is known, as per Memo 8.02).

Encasement on the banks is required because local scour around the pile result in the pile being in water almost all the time.

The policy for painting piles is in transition. Due to problems with paint systems, the policy has reverted back to using 2P coating for the time being (covered in the standard specifications under 870.2.05). Here is a general note that can be used:

```
SPECIAL PROTECTIVE COATING - CLEAN AND PAINT PILES AND SWAYBRACING IN
ACCORDANCE WITH SECTIONS 520, 535, AND 870.2.05 OF THE GEORGIA DOT
SPECIFICATIONS. PAINT SHALL BE SPECIAL PROTECTIVE COATING NO. 2P.
```

For information, here is the former paint policy: All exposed steel piles, and swaybracing if present, shall be painted. Paint System VI will be used in the non-compliance areas, and Paint System IV will be used elsewhere. The paint shall conform to the specified system except that the top coat will be black (Federal Std. No. 595, color 27040). The

General Note in BRNOTES should be used; it calls for System VI and will have to be changed where System IV is required. The counties in the non-compliance areas are Barrow, Bartow, Bibb, Carroll, Catoosa, Cherokee, Clayton, Cobb, Coweta, Dekalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Hall, Henry, Newton, Monroe, Murray, Paulding, Rockdale, Spalding, Walker, and Walton.

5 Retaining Walls

5.1 General

Retaining walls shall be designed in accordance with AASHTO Standard Specifications for Highway Bridges, Section 5, Retaining Walls, and as noted in this section.

The designer shall determine the most appropriate wall type for each particular application considering economy, constructability and geotechnical conditions. Coordinate with road designers so they will understand the limits of right-of-way required for the type of wall specified. This coordination must take place during the preliminary design phase, before Right of Way plans are approved. The viable wall types to be considered in making the selection of wall type include:

Wall Type	Description	Design Method
Rigid Gravity	Gravity Wall MSE Wall Prefabricated Modular Wall Modular Block Wall	Conventional Design Contractor Design Method Contractor Design Method Contractor Design Method
Semi-Rigid Gravity	Reinforced Concrete Cantilever	Conventional Design
Non-Gravity Cantilever	Soldier Pile	Conventional Design
Anchored	Tie-Back Soil Nail	Contractor Design Method Contractor Design Method

Of these wall types the Department typically uses:
a) Cantilever walls
b) MSE walls
c) Gravity walls
d) Tie Back Walls
e) Soil Nail Walls

The other wall types have been used in the past for special situations.

Standard walls do not usually require wall foundation investigations and do not need to be reviewed by Bridge Design. This includes the gravity wall (Standard 9031L), median walls (Standard 4940), side barrier walls (Standards 4948A, B, and C), and parapet walls (Construction Detail PW-1) do not require review by Bridge Design. If the plans modify those standards, or for any other type of wall, a review is required.

Conventional Design requires that the wall designer provide complete wall details suitable for a contractor to bid and construct the wall to the geometry and structural details provided.

The Contractor Design Method requires that the wall designer provide the geometry requirements for the wall and the required wall type and design criteria only. The successful contractor completes the design within these given parameters

5.2 Preliminary Wall Plans

When a retaining wall is required on a project, the design office responsible for the project must submit the following information to the Office of Bridge Design:

1. An elevation view (profile) of the wall showing the following:
    a. Beginning and ending wall stations
    b. Elevations on top of the wall at the beginning, end, and at profile break points
    c. The original ground profile
    d. The proposed ground profile
2. Roadway cross-sections in the vicinity of the wall that show the existing and final slope behind the wall
3. Project Cover Sheet
4. Project typical sections associated with the wall
5. Project plan-and-profile sheets showing the following:
    a. Limits of right-of-way
    b. Superelevation data
    c. Horizontal and vertical alignment data
    d. Horizontal offsets to the face of the wall, gutterline at barrier or face of parapet on the wall as applicable
    e. Location and height of any sound barriers on the wall
    f. Location of any overhead signs near the wall
    g. Location of any roadway lighting near the wall
    h. Location of any drainage structures that will affect the wall
6. Any construction sequence requirements for the wall construction
7. Any architectural treatment required for the wall

The requirements apply for any special design walls, whether cast-in-place, MSE panel walls, or modular block walls.

The Wall Designer shall make an initial recommendation on wall type and submit the plan, profile and wall type recommendation to the Bridge Office for concurrence.

After the Bridge Office concurs with the wall recommendation the Wall Designer shall request a Wall Foundation Investigation. Preliminary Plans shall be developed based upon the recommendations previously approved and the Wall Foundation Investigation. If the WFI reveals unexpected geotechnical conditions the Designer shall, if appropriate, prepare a second wall recommendation to the Bridge Office for concurrence prior to proceeding with Preliminary Plans.

5.3 Final Wall Plans

The designer shall prepare wall plans in accordance with the design method shown on the wall type selection chart.

With either method, the top of wall should be designed to present a smooth pleasing curve with no sharp breaks, peaks or valleys. The final top of wall profile shall be properly coordinated with the roadway designer to ensure roadway cross sections are correct. The Wall Designer shall ensure that the Plans consider the required right of way, easement and/or temporary shoring as appropriate to build the structure. The Wall Designer should consider special surcharges to be imposed on the wall and the impact of wall construction on existing adjacent structures.

Ensure the wall footing is set low enough that it will not be influenced by any adjacent (possibly broken) water line.

5.3.1 Conventional Design

Walls designed to a conventional design method shall be designed to resist earth pressure and surcharge loading and shall be checked for settlement and global stability.

The wall designer shall develop details to include:

- Relief of water pressure behind the wall.
- Adequate treatment of surface water on the ground immediately behind the wall.
- Waterproofing of structural elements
- Lighting Details
- Overhead Sign Details
- Drainage Structures
- Pay Quantities

5.3.2 Contractor Design

For walls to be procured using the Contractor Design method the designer shall prepare final wall layouts depicting required envelopes, profiles and wall type. Standard Specifications and Special Provisions shall dictate the requirements imposed on the design-builder with respect to design criteria, method, submittals and details. The information to be provided by the designer to the design-builder shall include:

- Wall envelopes
- Location of vertical construction joints
- Typical Sections
- Geotechnical design criteria including wall design parameters
- Special loading (for instance vertical loads from foundations adjacent to the walls)
- Special requirements to be incorporated such as lighting, overhead sign structures and drainage structures.
- Pay Quantities

In preparing the wall envelopes for use by the contractor design method, the wall designer shall consider:

- Profile Grade
- Barrier Details (on top of wall)
- Barrier Details (at face of wall)
- Drainage Requirements
- R/W Restrictions

Prior to approving the calculations and plans for contractor designed walls, the checker should have a letter from the contractor stating that the wall has been staked out and that it fits the site. See Section 149.3.03.D of the Standard Specifications.

5.4 Special Consideration for Individual Wall Types

5.4.1 Gravity Wall

Gravity walls (plain concrete or masonry rubble) to a maximum height of 10 feet shall be specified in accordance with the Standard Details.

5.4.2 MSE Walls

Contractor-designed walls are governed by Section 627 of the Standard Specifications. This specification covers the design and construction of MSE walls, and refers to Section 626 for additional construction requirements. Section 627 does not allow additional payment for location of steps in the leveling pad. Instead payment is restricted to the wall envelope area in the contract plans (unless the envelope changes due to field conditions).

The pay quantity for pre-designed walls (Section 626) is from top of leveling pad to top of coping. See Figures below for the correct and incorrect ways to calculate the wall face pay item quantities. Vertical bands of the wall are paid for according to the height range of that band.

Bridge replacements with wall abutments are often stage constructed. A vertical joint is required between the stages to allow for differential settlement.

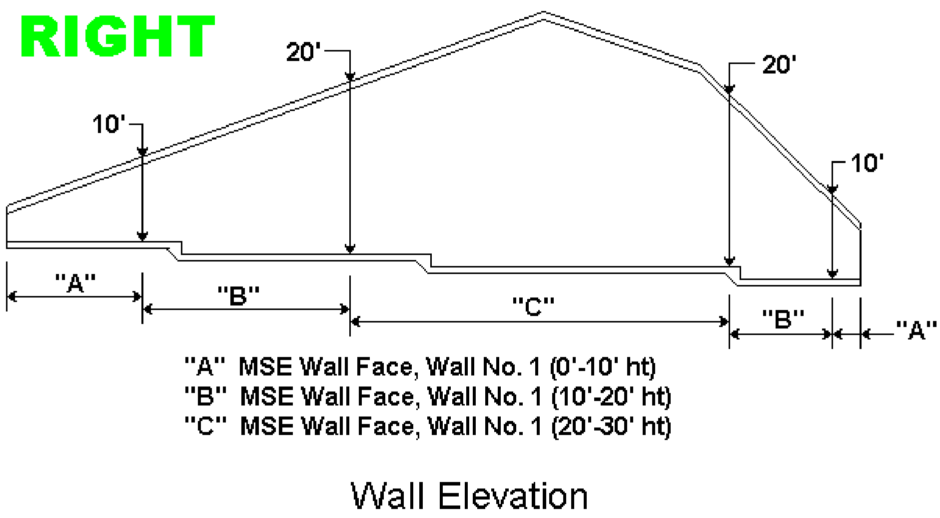


Figure 5-1 Correct method of quantifying by wall height

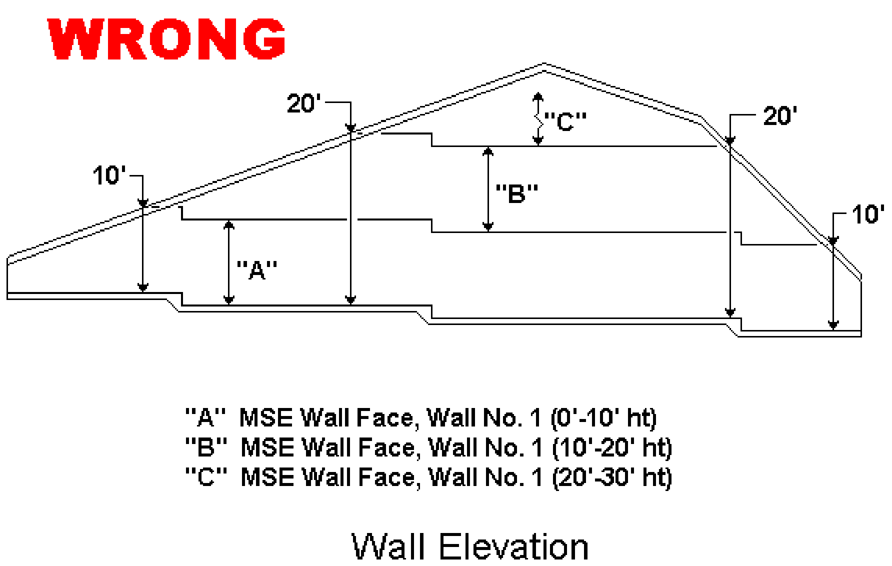


Figure 5-2 Do not use horizontal bands for wall height

5.4.2.1 Design Criteria

All MSE Walls shall be designed and constructed in accordance with the following requirements:

1. The minimum cover from the proposed ground line to the bottom for the wall (top of leveling pad) shall be two feet. Increase the cover as needed:

    a. Cover shall be sufficient to provide 2' of cover below bottom of adjacent ditch.

    b. Where the proposed ground line slopes downward from the front face of the wall, the elevation of the bottom of the wall (top of the footing) shall be set to maintain a minimum 10 ft. berm (see Figure 5-4).

    c. Footing must be set below the level of utilities like water lines that could scour the footing out if they were to break.

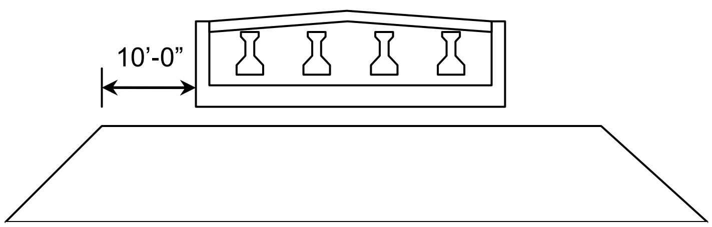


Figure 5-3 Shoulder Point for Abutment Walls

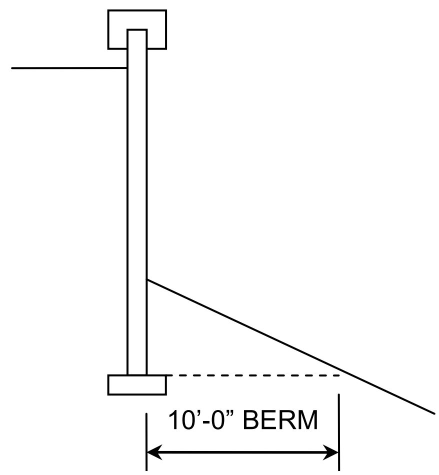


Figure 5-4 Berm in Front of Wall

2. At abutment walls, place shoulder points of the top of the wall 10'-0" outside of wingwall (see Figure 5-3).

3. The maximum slope behind the wall shall be 2 horizontal to 1 vertical.

4. The top elevation of all walls which retain sloping backfills shall be set to provide a 1' – 6" deep drainage ditch. Use a trapezoidal paved ditch. If flow is minimal use the small ditch shown in Figure 5-5. Do not use V-shaped ditch intended for gravity walls.

5. For MSE walls detailed as the front face of an end bent (abutment) the minimum distance, measured normal to the wall, from the Back Face of Paving Rest to the front face of the wall shall be 6'-0".

6. At wall abutment, the backfill behind the end bent and end of bridge must be paid for separately (backfill for the wall is included in the square foot price of wall on

contractor designed walls). This fill must also be extended back further in order to use the same length of straps as the rest of the wall (see Figure 5-5)

7. Before using MSE walls on urban streets, the Designer shall investigate to see if underground utilities will interfere with the wall systems and their modules or straps in any way. In general, MSE walls shall not be used in situations in which maintenance crews of the underground utilities will dig into the straps, mesh or modules. Conventional retaining walls shall be used in these instances.

8. Overhead sign foundations shall not be placed on the reinforced backfill of MSE walls.

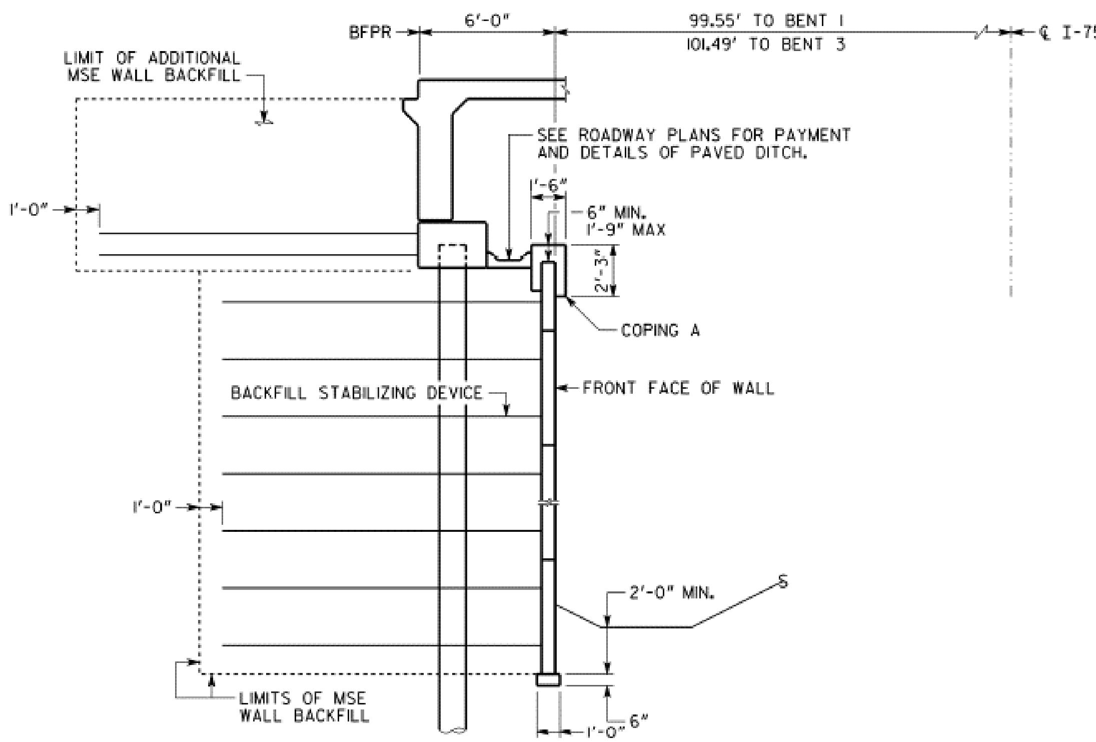


Figure 5-5 Typical wall abutment detail with low-flow ditch

5.4.2.2 Foundation Investigation

MSE type walls, by their nature do not require massive structural foundations. However the earth mass contained by such walls will very likely cause settlements in the system depending upon the nature of the material on which the system is founded. If it is consistent, this settlement causes no problems; however, if the underlying conditions are inconsistent, there is a possibility of differential settlements along the length of the wall, which would be intolerable.

Therefore the Designer should insure that sufficient foundation investigation has been accomplished, and recommendations have been received from the Laboratory concerning the use of MSE walls at each location.

The Designer should also insure that bridge abutments at MSE walls are mechanically separated from the walls so that the rigidity of the abutment will not affect the wall as it settles.

5.4.2.3 Erosion Protection for End Bents

When detailing bridge foundations on MSE walls, the area between the front face of the end bent cap and the back face of the wall shall be completely covered with 4-inch concrete slope paving. This is done to preclude erosion or loss of fines from concentrated water flowing in this area. The plans should note that costs for this slope paving should be included in price bid for contract items. The slope paving should be placed as soon as possible after the cap and wall coping are in place.

5.4.3 Prefabricated Modular Wall

Prefabricated Modular walls (such as Doublewal) shall be procured using the Contractor Design method as described in 5.3.2, and will require a Special Provision to be included with the Contract Documents.

5.4.4 Modular Block Wall

Modular Block walls (such as Keystone) shall be procured using the Contractor Design method as described in 5.3.2, and will require a Special Provision to be included with the Contract Documents. (This is type of wall is not typically allowed for support of highway facilities but is allowed in special situations for miscellaneous structures.)

5.4.5 Reinforced Concrete Cantilever Wall

There are concrete cantilever walls included in Standards 4948A, B, and C and Construction Detail PW-1 that can be used without design or review by Bridge Design. These range in height up to 12’-13’.

The Bridge Design Basic Drawings web page includes some “Special Design Retaining Walls” that still must be reviewed by Bridge Design and require a Wall Foundation Investigation to determine bearing pressure. These basic drawings include reinforcement details for different wall heights, but a summary of quantities is still required along with a rebar table, general notes, plan and elevation views, geotech info, etc.

Any other walls or modifications of standardized walls shall be fully designed and detailed in accordance with current AASHTO criteria. The designer shall utilize standard

Department cell details for initial sizing of the walls and for final details. Counterforts are allowable when this generates a cost-effective design.

5.4.6 Soldier Pile Wall

Soldier Pile walls are typically used as temporary shoring – and in this situation are designed and detailed by the contractor under his temporary works shop drawing requirements. Permanent Soldier pile walls, with no ties, when required for special situations shall be fully designed and detailed in accordance with current AASHTO criteria.

5.4.7 Tie-Back Wall

Tie-back walls shall be procured using the Contractor Design method as described in 5.3.2. Shotcrete (pneumatically applied concrete) will not be permitted as the permanent facing for tie-back walls. Instead, the permanent facing shall be cast-in-place concrete.

5.4.8 Soil Nail Walls

Soil nail walls are similar to tie-back walls but are subject to settlement and can not be built vertically. Therefore they should not be used to support structures and are rarely used by the Department for permanent construction. Because they use shotcrete, if the installation is permanent, some type of finish must be specified that may consist of finishing the shotcrete or casting a surface finish in place afterwards. Soil nail walls are designed by the Contractor.

5.5 Staking of Retaining Walls on Construction

For construction requirements for staking retaining walls, see Specification Section 149.3.03.D. Prior to approving the calculations and plans for contractor designed walls, the checker should have a letter from the contractor stating that the wall has been staked out and that it fits the site.

6 Culverts

Culverts for GDOT projects are normally considered a Roadway item and as such are normally handled by the Roadway/Hydraulic Designers. However, occasionally it becomes necessary for the structural engineer to be involved with the design of a culvert and therefore the following provisions are offered

6.1 Culvert Sizing

The approved methods for sizing culverts are detailed in the GDOT Drainage manual.

6.2 Standard Culvert Design

Whenever possible the designer should strive to use the Pre-designed Reinforced Concrete Culverts located in the GDOT roadway standards.

When unusual circumstances preclude the use of a standard Culvert, the designer may create a special design culvert utilizing the GDOT program BRGABOX.

Please see the following letter from the State Bridge Engineer regarding controlling cracking in the standard culverts.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

INTERDEPARTMENT CORRESPONDENCE

FILE **General**

OFFICE Atlanta, GA

DATE October 23, 2001

FROM Paul V. Liles, State Bridge Design Engineer

TO Jim Kennerly, State Road and Airport Design Engineer
Joe Palladi, State Urban Design Engineer
Jimmy Chambers, State Consultant Design Engineer
Rhonda Davis, State Aid Administrator
All District Engineers (7)

SUBJECT **PROPOSED PLAN NOTES FOR BOX CULVERTS (W/ ENGLISH UNITS)**

Included in this letter are notes that pertain to the construction of cast-in-place box culverts. The function of these notes is to limit the minimum earth cover and to define the desired treatment of vertical construction joints in culvert barrels, thereby attempting to minimize concrete cracking that tends to occur with settlement of culverts. The treatment of minimum cover and construction joints is not presently addressed uniformly by GDOT specifications or culvert standard drawings.

The Office of Construction, with concurrence by this office, has requested that the notes be placed in a prominent position along with normal box culvert details on all project plans that involve box culverts having English measurements. It is suggested that a suitable plan location for the notes might be at each drainage cross section view where a box culvert is required:

BOX CULVERT REQUIREMENTS:

MINIMUM FILL HEIGHT FROM TOP OF CULVERT TO BOTTOM OF BASE WITHIN TRAVELWAY SHALL BE 12 INCHES.

MAXIMUM POUR LENGTH SHALL NOT EXCEED 30 FEET ALONG THE LENGTH OF THE CULVERT.

TRANSVERSE CONSTRUCTION JOINTS SHALL BE PLACED IN THE BARREL, NORMAL TO THE CENTERLINE OF CULVERT, AT THE OUTSIDE SHOULDER BREAK POINTS. LONGITUDINAL BARREL REINFORCING STEEL SHALL NOT BE CONTINUOUS THROUGH THESE JOINTS, PROVIDED THAT THE JOINTS ARE MORE THAN 15 FEET FROM THE BARREL ENDS.

WHEN TRANSVERSE CONSTRUCTION JOINTS OCCUR WITHIN 15 FEET OF THE BARREL ENDS OR WITHIN THE LIMITS OF THE PAVEMENT, THE LONGITUDINAL BARREL REINFORCING SHALL THEN BE CONTINUOUS THROUGH SUCH JOINTS. THE MINIMUM LENGTH OF LAP SPLICE FOR LONGITUDINAL REINFORCING SHALL BE 24 INCHES.

TRANSVERSE CONSTRUCTION JOINTS PLACED AT ANY OTHER LOCATION NOT SPECIFIED ABOVE SHALL BE FORMED WITH NO LONGITUDINAL REINFORCING STEEL PASSING THROUGH THE JOINTS.

Similar notes, using equivalent metric units, are already in force on the standardized metric box culvert drawings. Therefore, the additional actions proposed by this letter do not apply to any metric projects.

If you have any questions please contact Bill Ingalsbe of this Office at 404-656-5302.

PVL:CCP:jym

cc: John Tiernan, attn: Bill Ingalsbe
David L. Graham, attn: Melissa Harper

6.3 Three-Sided or Bottomless Culverts

Bottomless culverts are allowed only when no other practical solution (such as a bridge or standard box) will satisfy the project requirements. This may occur in extremely rare instances where the only way to obtain an environmental clearance is through the use of a bottomless culvert. In this case the detailed plans for the bottomless culvert must be included in the contract documents. The foundation design for the bottomless culvert must be included in these details and sealed by a Professional Engineer registered in the State of Georgia. In addition, the foundation design must detail how the bottomless culvert foundation will be protected from scour. In general, rip-rap is NOT considered satisfactory for protecting a spread footing from scour – footings must be keyed into solid rock or founded on piling embedded well below the scour line.

The provisions for the sizing of Bottomless culverts are outlined in the GDOT drainage manual.

7 Miscellaneous Structures

Miscellaneous Structures shall include those structures not covered by preceding sections of this document. The following miscellaneous structures may be required for Georgia DOT projects:

7.1 Temporary Detour Bridges

It is important to note that this section is intended to provide general guidelines for the implementation of temporary detour structures - engineering judgment should still be applied at each site by a qualified engineer.

For a widening project, the sequence used to construct the project may require the use of a temporary detour bridge. Temporary detour bridges are used to facilitate the construction of the project and are intended to be removed upon either completion of the entire project or at a particular project stage.

Temporary detour bridges are generally used for stream crossings; however, they might be utilized to cross other features such as a railroad track or vehicular roadway.

Section 541 of the Standard Specifications covers the Materials, Design, Construction, Maintenance, Removal and Payment for Detour Bridges

Temporary detour bridges are to be studied on a case-by-case basis. While each situation is unique, there is a general design approach which can and should be observed.

The detour structure and roadway are to be sized to safely convey the appropriate design storm while remaining open to traffic. Standard Department procedures are to be used to develop the peak runoff for the appropriate design storm. The rural flood frequency regression equations will usually be applicable. If a situation exists where there is appreciable development in the upstream watershed, the urban regression equations should be considered.

Detour structures are to be evaluated using a water surface profile program (HEC-2, HEC-RAS, WSPRO, etc.) for the natural (unconstricted) stream conditions, the existing bridge and temporary detour bridge conditions. Temporary detour structures are to be sized to convey the 10-year design storm for all roads designated as State Routes or those local roads which have a design-year ADT greater than 400 vpd. For local roads whose design-year ADT is less than 400 vpd, the temporary detour structure shall be sized to convey a 2-year design storm. The design-year storms (10-year and 2-year) apply to both flood stages and velocity comparisons.

To establish the length, elevation and location of a temporary detour bridge, the following guidelines should be used:

7.1.1 Temporary Detour Bridge Length

1) Compare the stream velocities between the natural (unconstricted) stream and the existing bridge opening. If the existing bridge velocities are less than approximately 2.0 times the natural (unconstricted) velocities and there are no visible signs of scour at the existing bridge, then consideration can be given to having a temporary detour bridge length less than the existing bridge. The detour bridge length should be minimized. A temporary detour bridge length approximately 2/3 the length of the existing bridge length (typically a good first iteration) should be considered – though this must be analyzed, verified and refined if necessary. A temporary detour bridge length less than the existing bridge will act as a constriction and will tend to increase backwater upstream of the bridge. The temporary detour bridge length should remain large enough so that it will not induce:

    a. Design-year velocities through the temporary detour bridge opening which are more than approximately 2.0 times the natural (unconstricted) stream velocities unless:
        i. The temporary detour bridge length matches the existing bridge length, or
        ii. The streambed is comprised of a scour-resistant material
    b. An increase in the design-year backwater more than 1.0 ft above the existing bridge conditions

2) If the existing bridge velocities are greater than approximately 2.0 times the natural (unconstricted) stream velocities or there are visible signs of contraction or local scour at the existing bridge, then the temporary detour bridge shall be the same length* as the existing bridge. *See note 5 below.

3) The length of the temporary detour bridge shall be long enough to ensure that the toe of slopes of the bridge be a minimum 10.0 ft from the top of banks of the main channel. This buffer zone is needed for erosion control measures.

4) Temporary bridges should be studied in incremental lengths divisible evenly by 20.0 ft.

5) While unlikely, it is possible that a temporary detour bridge can be longer than the existing bridge. This scenario could arise as a result of extreme or unusual hydraulic circumstances. The designer and the Department should be in agreement before specifying a detour bridge longer than the existing bridge.

7.1.2 Temporary Detour Bridge Elevations

1) If the temporary detour bridge length is to be the same as the existing bridge length, then the low member of the temporary detour bridge shall clear the design-year (10-year or 2-year) flood stage elevation of the existing bridge (constricted) condition by approximately 1.0 ft.

2) If the temporary detour bridge is to be shorter than the existing bridge, additional backwater may be generated. In this situation, there are several factors which should be considered:

   a. The design-year (10-year or 2-year) flood stage upstream of the bridge should not be increased by more than 1.0 foot. Examine the area just upstream of the bridge. If there are homes, businesses, property, etc. which would be impacted by raising the flood stage upstream of the temporary bridge, then the temporary detour bridge length should be as long as the existing bridge.
   b. If there are no properties upstream of the temporary detour bridge which could be impacted by a rise in the design year flood stage, then the superstructure (low steel) of the temporary detour bridge elevation shall be set to clear the design-year (10-year or 2-year) flood stage elevation induced by the temporary detour bridge constriction by approximately 1.0 ft. This rise should not exceed 1.0 ft. This rise should be limited so that it does not generate velocities more than approximately 2.0 times the natural (unconstricted) stream velocities unless streambed geology permits.

3) Streambed geology should be considered. If the streambed is comprised of a scour-resistant material, velocity increases greater than approximately 2.0 times the natural (unconstricted) conditions might be inconsequential. Therefore, in these geologic conditions, the bridge length could possibly be reduced more than with a sandy stream bed. However, the maximum 1.0 ft increase in backwater should still be observed.

4) Temporary detour roadway geometrics – specifically profiles – should be considered when setting the elevation of the temporary detour bridge.

7.1.3 Temporary Detour Bridge Location

1) It is recommended that unless other considerations exist (environmental, right-of-way, buildings (or other structures), utilities, roadway geometry, channel geometry, etc.), the temporary detour

bridge be located downstream of the existing bridge. This should ensure that, in the event that the temporary detour bridge is breached during a design flood, its failure will not result in the loss of the existing bridge or the proposed bridge.

2) For 2-lane bridges, the centerline to centerline distance of the temporary detour bridge to the existing bridge should be a minimum of 50 ft. This offset should ensure the constructability of the temporary and permanent bridge as well as the temporary and permanent roadway. At the engineer’s discretion in spatially-constrained situations, this offset distance can be reduced to as little as 42 ft.

3) It should be assumed that the temporary detour bridge be centered about the stream channel and/or aligned with the existing bridge.

The following is additional guidance:

7.1.4 Temporary Detour Bridge Width

Provide the number and width of lanes detailed in the roadway detour plans. Lane widths less than 11 feet are generally unacceptable for interstate detours. 10-foot lanes are generally the lower limit for non-interstate roads

Provide 2-foot minimum clearance from edge of lane to traffic barrier.

7.2 Pedestrian Bridges

Occasionally, project requirements include the need for pedestrian bridges. These structures shall include bridges which primarily carry pedestrian and/or bicycle traffic.

The design of these structures shall be in accordance with the following:

- AASHTO Standard Specifications for Highway Bridges, 16th edition, and
- AASHTO Guide Specifications for Design of Pedestrian Bridges, 1997.

Note that ADA requirements require that no grade be steeper than 1:12 (8.33%).

Projects which require pedestrian bridges will, likely, have very specific architectural requirements. The bridge form, itself, may require coordination with the Department on the applicable codes to use in the design of the structure.

Coordinate regularly with the DOT project liaison prior to commencing work on this structure.

7.3 Sign Supports

Georgia DOT has the following standard drawings to address sign supports.

GDOT Standard Drawings:

4030 Details of Galvanized Metal Circular Guardrail for Protection of R.R. Signs
9023A Railroad Grade Crossing Signs and Markings
9024A Railroad Grade Crossing – Railroad Signing and Marking at Crossing with RR Signals and/or Gates
9041 Assembly Details on Aluminum Bolted Extruded Panels for Special Roadside Signs
9042 Aluminum Bolted Extruded Panels Assembly Component Details (For Special Roadside Signs)
9054A Erection and Foundation Details for Special Roadside Signs - Breakaway Type Posts
9054B Erection and Foundation Details for Special Roadside Signs - Breakaway Type Posts
9054C Erection and Foundation Details for Special Roadside Signs - Breakaway Type Posts
9055 Erection and Foundation Details for Special Roadside Signs - Breakaway Type Posts (Wood) (To be used only where specified)
T-03c Details of Strain Pole Erection for Overhead Signs
T-03d Details of Timber Pole Erection for Overhead Signs

Structures not addressed by these standards shall be designed in accordance with:

2002 Interim to Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 4th Edition

Cable-supported signs: Overhead lane signs are sometimes needed over bridges with turn lanes. These signs are attached to tensioned wires supported by Type I-III strain poles. Whenever possible, these strain poles shall be stand alone structures with their own foundation. However, in some urban areas there is not an appropriate place to locate a strain pole on the ground and therefore a steel strain pole (not PSC) must be mounted on the bridge. When this situation occurs, strain poles shall not be supported on the bridge superstructure. When placed on the substructure, both of the poles in the pair shall be at the same bent location and the cables attached to the poles shall be parallel to the bent. This will keep all loads in the plane of the bent. The anchor bolts are typically 54 inches long therefore on caps less than 57 inches deep through-bolts are usually used.

Type IV strain poles supporting cable or mast-arm mounted traffic signals are generally not allowed on bridges.

Sign supports that are not addressed by these standards are designed by the Contractor. The contractor is required to submit shop drawings for approval by the Engineer.

7.4 Light Standards

Georgia DOT has the following standard drawing to address light standards.

GDOT Standard Drawings:
TS-0 Details of Metal Traffic Signal Support Structures
TS-05 Details of Concrete Traffic Signal Strain Poles
TS-06 Details of Strain Poles and Mast Arm Pole Foundations
TS-07 Grounding Details for Overhead Span Wire Signs and Traffic Signals

Structures not addressed by these standards shall be designed in accordance with:

2002 Interim to Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 4th Edition

7.5 Sound Walls

Sound walls are barriers erected to attenuate noise created by transportation facilities.

The system used is a wall comprised of posts (steel rolled beam sections) supporting horizontal panels made of corrugated sheet metal or flat concrete panels. The posts are embedded in the ground inside concrete piers or are mounted with bolted base plates to barriers or retaining walls. The corrugated metal panels are attached to the rolled-beam posts by self-tapping screws. The concrete panels are attached to the posts by bolted compression clamping.

The walls shall be designed according to the Guide Specifications for Structural Design of Sound Barriers, 1989

Over time, Georgia DOT has developed example drawings for both metal panel and concrete panel sound walls. While, these drawings are not “standard drawings”, they are provided and accepted for use, where applicable on GDOT projects. Contact the Office of Bridge Design for a copy of these drawing

8 Re-Designs, Shop Drawings, and As-Builts

8.1 Contractor Re-Designs

Proposals by the Contractor to redesign the project are subject to approval on a case-by-case basis by the Office of Construction. Generally if it is a cost-saving measure the Contractor must share the savings equally with the Department. In all dealings with the Contractor, make sure to keep the DOT field engineers informed and work with the liaisons of the Office of Construction.

When the Contract plans feature Reinforced Concrete Deck Girders, some contractors will submit a re-design utilizing either Pre-Stressed concrete stems or Type I Mod Beams. This will be accepted only if the freeboard requirements outlined in the drainage manual are met with the proposed re-design.

The Standard Specifications allow the substitution of welded wire fabric (WWF) for rebar in PSC beams, but do not address substitutions in other components. It is the policy of the Office of Bridge Design to allow such substitutions as long as the WWF will provide an area of steel equal to the Plan value in each direction. No reduction in area will be allowed based on higher strength of the wires in the WWF.

When the Contractor causes a construction problem, it is Department policy for the Contractor to propose a solution which must be approved by the Department. The Department avoids telling the Contractor how to correct the problem. Any damages or reduction in payment are worked out by Construction.

When there is an error on the plans, the Department will typically propose corrections.

When unexpected conditions are encountered that force a change to the design, the solution is worked out with all parties.

8.2 Shop Drawings

Shop Drawings are required per the standard specifications Section 105.02. On most bridges this includes metal deck forms, bearing pads, and PSC beams. Other shop drawings include steel beams (and anything else fabricated from steel), detour bridges, cofferdams, fencing, handrail, other types of bearings, etc. They are delivered via the contractor, not directly from the fabricator. If this is not the case, the contractor must be notified and a review will not commence until a letter covering the drawings in question is received.

Shop Drawings usually have to be submitted as full-size plans, but they are now allowed to be submitted as half-size by Special Provision.

Because the fabricator must have the plans approved before he can start work, shop drawing approvals are often time critical, so reviews should be prompt (typically within two weeks) and records must be kept of when shop drawings were received and when they were returned to the contractor. However there is no review period defined typically. Always make sure the shop drawings are stamped and signed by a P.E. if a design change is involved. Pay special attention to where different companies are involved and may not have communicated, for instance in regards to beams and deck panels or beams and diaphragm holes or handrail post spacing on the shop drawings vs. the insets that will be built from the bridge plans.

It is GDOT policy that EVERY page of EVERY copy of approved shop drawings receive the approval stamp. Stamping only the first sheet of a set is NOT acceptable and will be returned to the reviewer. Only the first sheet of design calcs needs to be stamped.

8.2.1 Correspondence

See the Section 1 for distribution of shop drawings that have been reviewed. Shop drawings are never “Approved as noted”. If changes are minor we have allowed corrected sheets to be swapped out so the entire set can then be approved.

Shop drawings reviewed by consultants must be sent through Bridge Design who will also stamp them after the consultant’s review. Fabrication is not allowed to proceed without a stamp by the State Bridge Engineer. The policy where “Big Bridge” program shop drawings could use a consultant stamp “on behalf of” the Consultant Design or Bridge Design engineer is no longer in effect.

The designer shall keep a shop drawing log showing the date of the submittal to the Bridge Office, date of return to the Contractor and an indication of approval or exceptions to the shop drawings.

All original shop drawing transmittal letters, both “in” and “out” shall be sent to the General Files. This should be done by including the original letter with the sets of drawings provided to the office clerk for transmittal. All other parties shall get photocopies of these letters.

8.2.2 Metal Deck Panels

Metal deck form shop drawings must be stamped by a P.E. When checking metal deck panels make sure the gauge of steel is correct and that the sag does not exceed the allowable. Because there are only a few suppliers, these shop drawings are easy to approve. However you also need to check that the PSC beam plans jibe with the metal deck forms since the clips must be located correctly on the beams in order for the deck panels to be installed. Therefore don’t approve metal deck panels until you can also review the PSC beams.

Stay-in-place metal deck form shop drawings indicating intermediate supports between beams shall not be approved. In addition, the Designer shall check the gage being furnished by the supplier to ensure that the steel forms are sufficiently stiff to keep deflection within acceptable limits. Metal stay-in-place deck forms shall have a minimum of 1” of bearing on the support angle at each end, as per Section 500.08.E.10.

For steel beam bridges make sure straps will be used in areas where the top flange of the beam will be in tension.

Hangers for metal stay-in-place deck forms shall not be welded to tension members of steel bridges. This means that for continuous steel beams, there shall be no welding along the flange area where the top flange is in tension under any loading condition. These locations should be clearly indicated on the plans.

Approved shop drawings for metal deck panels are no longer forwarded to the Lab. This is different than just about any other shop drawings.

8.2.3 Bearing Pads

Generally bearing pads are not redesigned, but they are required to be redesigned for t-beam bridges that go to Type I Mods. Even under Type I Mods, you can still use 0.5" plain pads if you are not more than 40' from a fixed bent and no sealing rib is required. For these shop drawings make sure the pads are detailed as per the plans and the correct materials (e.g. durometer hardness) are used.

8.2.4 Prestressed Beams

The fabricator often tweaks the design of the beam in order to make production more efficient. If they change the beam they need to submit calculations that the beam work and will need to submit reproducibles for inclusion in the record set of plans.

Things to check for include all elements of PSC beam design, for instance the stirrups can not be put on the inside of the strands in the web and draped strands should not conflict with diaphragm holes or the bearing chase. Verify dimensions which may be slightly different from fabricated lengths which do not include shortening when the strands are released but do include differences in length due to the grade.

If the beam is exactly the same the fabricator does not need to submit calculations, but you will need to verify concrete strengths, materials, strand pattern and dimensions. Check for proper location of diaphragm holes since improper placement won't be noticed until the beam is put in place and generally results in having to core the beam which can cut strands.

You will need to make sure the metal deck forms shop drawing are compatible with the location of the beam clips and that overhang brackets are included on the exterior beam.

At the request of the contractors, PSC beam fabricators have been showing pipes in the tops of PSC beams to support posts for safety railings on the beams. This detail is not acceptable since these pipes hold water which freezes and causes splits in the beams. An alternative detail which has been approved and which remains acceptable is to use a reinforcing bar extending out of the beam over which the post is placed. This bar should be cut off or bent into the deck steel after the safety rail is no longer needed.

Assure that lifting devices are adequately embedded in the girder ends. The lifting devices shall extend to within 4" of the bottoms of girders so that the weight of the girder will not cause tension stresses at the junction of web and top flange.

Do not approve shop drawings showing the web stirrups inside the strands in the web.

Do not approve any shop drawings that call for strand release in less than 18 hours, since this violates the provisions of the Standard Specifications.

When checking shop drawings for prestressed concrete beams, please be certain that the chamfers on the bottom of the beam at the ends are not larger than ¾" for Type I through Type IV beams and not larger than 1" for Type V and Bulb-Tee beams.

Fabricators of PSC beams sometimes redesign beams to use two hold-downs instead of one to reduce the hold-down force. The two hold-downs are usually placed close together so that the effect on the design is minimal. If there are no other changes in the beam design, the fabricator will not be required to provide redesign calculations provided that the hold-downs are within 3'-0" of the designed location of the single hold-down.

Fabricators of PSC beams often show pick-up points on the beams farther from the end of the beam than is shown on the detail sheet, particularly with Bulb-Tee beams. In the future, we will approve shop drawings only when the pick-up points are within 1.5 times the beam depth of the end of the beam.

Approved shop drawings for PSC beams are cc'd to the head of the concrete branch at OMR instead of the inspection section.

8.2.5 Detour Bridges

The contractor must design the detour bridge and is responsible for it. Make sure a PE has stamped the plans and generally make sure the plans look reasonable and are in compliance with the plans in terms of length, width, and minimum bottom of beam.

Some bridge contractors (e.g. Southern Concrete) have pre-approved detour bridge shop drawings which are kind of like standard drawings except they own them. You do not have to review these approved drawings (since they have been reviewed and accepted by Bridge Design already) but can request them for your information. You still have to review whether the overall size of the bridge agrees with the size called for in the contract plans as well as the types of piles and also that the use of swaybracing for the height of the bents agrees with the height requirements on the approved drawings.

Approved detour bridge shop drawings do not need to be sent to the Lab.

8.2.6 Steel Beams

Shop drawings for all steel structures containing critical members, plate girders, etc. shall be scanned into a TIFF file and saved to a location set up by the Bridge Maintenance Engineer. This will generally include welded continuous rolled beams, plate girders, and pot bearings. Also, on anything out of the ordinary, consult the Bridge Maintenance Engineer to see if the shop drawings should be scanned for future reference. Typically this would mean sending shop drawings to the Plans File Room to be scanned into the record plan set. Unless the shop drawings involve some sort of design change, a PE stamp is not required.

8.2.7 Post Tensioning

The Bridge Designer shall make the approved post-tensioning shop drawings a permanent, reproducible part of the bridge file by having the reproducibles of the shop drawings placed in the bridge plans. Also, the Bridge Designer shall include in the file any pertinent calculations relative to the post-tensioning operation.

8.2.8 Walls

Where MSE or other walls are not designed, but left as an envelope with the wall to be designed by the contractor, the drawings will have to reviewed, approved, and included in the record set. They must be stamped by a P.E. since design work is involved. Section 627 does not allow additional payment for location of steps in the leveling pad. Instead payment is restricted to the original plan quantities based on the wall envelope in the contract plans (unless the envelope changes due to field conditions). Pre-designed walls (Section 626), however, are paid from top of leveling pad to top of coping.

8.2.9 Miscellaneous Shop Drawings

Most other items like fencing, shoring, and cofferdams do not require shop drawing review, but if they are submitted they will be reviewed.

8.3 As-Built Plans

As-built foundation plans are filled out by the DOT's project engineer and returned to the bridge designer. The values are then filled in electronically and a new sheet is generated to be added to the record set of plans. This is critical because if there is ever a scour problem the pile tip or footing elevation information will be very important in evaluating the bridge. It is also useful because often footing elevations change and the seal concrete thickness is not specified in the plans. See Section 1.4.22 for transmittal requirements.

Sometimes data pile information is sent to the designers by mistake. It should be sent on to the Lab for their records. These are usually on green sheets.

Other plan changes are usually handled as Use on Construction revisions but should also be included in the record set of plans.

Revision History

Section numbers listed below are hyperlinks

10-11-05:
Original issue

11-4-05:

1.2.1	Added coordination at concept
1.2.5	Added section about FHWA
1.3.1	Changed level of liaison to Group Leader
1.4.8	Routing letter no longer sent to Chief Engineer; routing coordination not required before completion of preliminary layout.
1.4.9.1	Changed number of half-sizes required for distribution to front office
1.4.12	Special Provisions to be reviewed by Bridge Design
1.4.15	Consultant may be asked to respond to Field Plan Reviews
1.4.16	Rack file is in Bridge Design
2.8	NCPIER for Category B only
3.1	Added slab charts (output from BRSLAB03)
3.1.7	Added section about Ride Quality
3.10.2	Allow 1 inch overhang for Type I Mod and Type II beams; bearing pad clearance to edge of cap refers to 4.3.2.1; added temperature cheat for BRPAD1
3.12.2.10	Removed older redundant beam charts
4.1.5	Added minimum seal thickness; guidance on showing bottom of seal or footing elevation
4.2.1	Added 9037 to note

12-22-05:

2.5.1	Added clarification to temporary shoring guidance
3.10.5	Added reminder about Seismic concerns to anchor bolts
3.13.5	Added guidance to leave diaphragm weight out of NCDL on plans
4.2.1	Added guidance on how many battered piles to add to comply with memos
3.4.4	Added guidance prohibiting Method 2 barrier being placed over a beam

5-18-06:

1.4.20	Added guidance about when revisions need to be lined through
App. A	Added as-built letter and RR data forms
3.1.1	Revised policy to use next available 7-inch slab design (blocked out slab charts)
3.3.2	Evazote end joints at end of bridge not less than 1.25 inches
3.12.5	Changed No. 3 bar in edge beam at end of Bulb Tee to No. 4 bar

6-14-06:

1.4.20	Add info about adding redesigns to electronic recordset
1.4.22	New procedure to send as-builts to Road Design directly instead of PM
App. A	Added link to new web page with sample letters
2.3.2	Added 17’ desirable vertical clearance over interstates

4.1.1 Renamed section; reworded info about test piles
4.1.2 Added info about caissons
4.3.3.3 Renamed section and added info about possible use of 2P coating
5.1 Coordinate wall limits with roadway designers before RW plan approval
5.4.8 Made a separate section for soil nail walls (formerly included with tie-backs)

9-29-06:

2.3.2 Removed reference to MOG 6625-2 requiring additional clear zone width for limited access highways. That MOG is now defunct.
2.9.3 Updated square foot costs for bridges
3.1.1 Updated design practice for 7-inch minimum slab. BRSLAB06 has been written to reflect 7-inch designs.
3.4.1.3 Modified maximum stirrup spacing in jersey barrier to 14 inches from 12 inches. This will allow stirrups to be placed at every other transverse deck bar in most cases.
3.7 Use couplers instead of long splices in staged construction of edge beams to provide more room at worksite. Increase thickness of edge beam on severe skews to keep the end of beam embedded. Allow optional mid-bay splice of 800 bars in edge beam to facilitate construction of t-beam spans.
3.12.5.1 Added more specific information about calculation of D dimension.
4.1.1.1 Made H piles its own section. Provided guidance on using larger piles than 14x89 and requesting a modification to the BFI.
4.1.3 Type II backfill does not increase bridge excavation
4.3.3.3 Now using 2P coating instead of paint on piles. Provided updated note.

10-4-06:

3.1.1 Updated slab charts with output from newer beta of BRSLAB06
3.4.1.3 Maximum barrier spacing reverted to 12 inches after an error was found in the calculations allowing 14 inches in the 9-29-06 update.

4-6-07:

2.3.3 Included revised Endfill Control Diagram, showing the Endfill Control Point
2.9.1.3 New section for widths of bridges on interstates.
2.9.3 Allow Type I Mod's to be utilized in designs in lieu of t-beams
3.1.1 Reduced maximum spacing of transverse deck reinforcement to 9 inches.
3.3.2 Updated paragraph regarding joints at ends of bridges. Now includes recommended joint sizes for various distances to fixity. Allows larger joints than previously with option for larger joints by permission.
3.4.1.2 Reduce height of bicycle rail from 54 inches to 42 inches to comply with LRFD AASHTO standards (overrules 17th edition).
3.4.1.3 Reduced maximum spacing of joints in barrier from 35' to 25' due to cracking in longer barrier segments.
3.8 On PSC beam bridges, use 18-inch endwalls for fixed ends (usually occurs only with one-span bridges). Made "endwall" one word.
3.10.2 Plan dimension of bearing pads are detailed to whole inches. Shim plate thicknesses are detailed to eighths of an inch.
3.12.2.2 Added language regarding strand placement to avoid conflict with bearing chase.
3.12.2.9 Added guidance on DF for PSBM1.
4.2.3 Added guidance to increase pile box size at end of wings to 3' when using 18-inch piles. Made "wingwall" one word.

4.3.2.1	Corrected cantilever proportion from 22% of column spacing to 22% of cap length.
8.2.1	Changed language to reflect current policy for shop drawings by consultants on “Big Bridge” projects to eliminate “on behalf of” stamp.

10-22-07:

2.3.3	Changed face of crash wall to outside of column instead of inside
2.9.3	Set 50’ as maximum span length on pile bents
3.1.1	Updated info to BRSLAB07. Updated slab chart output.
3.1.2	Included allowable stress of steel
3.2.3	New section to address location of longitudinal construction joints
3.3.2	If you size a 1-inch joint at the end of the bridge, you might as well use 1.25”
3.4.1.2	Updated to eliminate two pipe aluminum handrail; added info about architectural rail; possibly use fence on barrier over Atlanta interstates
3.4.4	Assume 2.5’ for width of temporary barrier
3.4.3.1	Two-pipe handrail to be used with permission only
3.7	More info about bar couplers in stage construction (get rid of 1’ rule)
3.8	Reference coupler info
3.12	Added 74-inch bulb tee chart
3.13.5.5	Added section to mention welding of stiffeners to web and flanges
4.1.1.1	Added info about Grade 50 files
4.1.2	Corrected top of shaft in ground from 2’ to 1’ below ground
4.1.4	Added guidance to start with square footings.
4.3.2.3	Added section for footings and cross referenced other footing sections
5.3	Added guidance about wall footings and water mains
5.4.2	Added info about payment of contractor designed MSE walls
7.3	Added info about cable-supported signs and strain poles

8-20-08:

3.1.4	Use Class C laps in #4’s and #5’s in deck reinforcement
3.7	Edge beam stirrups extend into deck
3.12.2.7	Beam dimensions are horizontal with no correction for vertical grade
3.13.6	Added note about fatigue welds being Class C
4.1.1	Note about typical batter of piles and maximum batter (4:12)
4.1.2	Minimum dry caisson size is 48 inches to allow inspection
4.1.5	Add note about special provision for seal concrete when there is no Class A
4.2.4	Correct type of rip rap to Type I
4.2.5	Added guidance and diagrams for slope paving in a railroad cut
4.3.2.2	Add requirement to space ties to allow 6-inch tremie
5.4.2	Clarify payment area of contractor-designed MSE walls
5.4.2.1	Added guidance and diagram about ditches on top of walls and wall abutments

3-11-09:

2.9.1	Revised bridge widths to match new MOG
3.4.1.2	Revised fence criteria so that sidewalks over railroads always have fence
3.5	Added guidance on deck drainage systems
3.7	Move information regarding outside bay edge beams to edge beam section
3.10.1	Include plate bearings in chart (bearing, sole, lube)
3.13.5.4	Corrected diameter of shear connectors to match cells

5-18-09:

2.9.1 Cleaned up old references to 6' sidewalk
3.4.2.1 Cleaned up old references to 6' sidewalk
3.5 Added guidance about increase slab thicknesses around deck drains outlets
3.10.2 Removed guidance about adding in 0.01 rad construction tolerance and 0.01 rad uncertainty tolerance for rotation on pads.
3.12.2.3 Add guidance regarding web width of PSC beams for composite slabs
3.13.3 Ignore strength of negative moment reinforcement in slab
5.4.2.1 Abutment walls should provide 10' of room outside of wingwall. Add diagrams for this and 10' berm.

7-23-09:

1.3.2 New section regarding review of final consultant plans
3.2.3 Do not put longitudinal construction joints over beams
3.6.1 Included weights of utilities from BIMS manual
4.1.1.3 Mention that metal shell piles in end bents and pile footings are not filled with concrete
4.1.4 Always include 180° hook on reinforcement in pile footings
5.1 Added guidance on which wall types require review by Bridge Design
5.4.5 New guidance on use of cantilevered concrete retaining walls
8.2.6 PE stamp is *not* usually required on steel shop drawings